APPENDICES

17 Mar 95

ENERGY ENGINEERING ANALYSIS PROGRAM

ENERGY SURVEY OF ARMY INDUSTRIAL FACILITIES

WESTERN AREA DEMILITARIZATION FACILITY HAWTHORNE ARMY AMMUNITION PLANT HAWTHORNE, NEVADA

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VOLUME II

PREPARED FOR

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

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APPENDIX E

Central Steam Plant and Steam Distribution System Retrofit Calculations

APPENDIX E
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WADF Steam System

Building 117-2 houses the central steam plant serving WADF facilities. The steam plant was originally designed and constructed under requirements for dual fuel firing, one of which was required to be coal. The smallest dual fuel capable boilers available at that time were installed. The three Keeler 50,000 PPH steam boilers do not "turn-down" well (low load efficiencies are much lower than efficiencies at greater loads) and have never been operated after their initial acceptance testing. They have been, and remain, "mothballed".

When the WADF was placed into operation several years ago, a packaged fire tube boiler was installed in the boiler plant to provide steam service only to WADF facilities at high efficiency. The boiler is located in the service bay at the North-West corner of the building and utilizes the deaerating Feedwater Heater and other ancillary equipment installed to serve the three 50,000 PPH coal fired steam boilers.

Boiler	Cleaver-Brooks	Input (DF-2):	16,738	MBH
	Model: CB 100-400		119.5	Gallons per Hour No. 2 Fuel Oil
	S/N: L-89956	Blower Motor:	15	HP
	Rated: 150 psi	Air Compressor:	5	HP
	Dated: 8/23/91	Primary Safety Controls:	4D	

Deaerating Feedwater Heater

Cleaver-Brooks
Model: 8M-100 S/N: D3-1935
Capacity: 100,000 PPH
Shipped: 7/23/76

Steam is distributed via surface and underground piping to WADF buildings. The system is shown schematically on Figure E-1.

Recommendations for Central Steam Plant and Distribution System Energy Conservation

During field investigations of the steam plant and distribution systems, several significant deficiencies were noted.

Deaerating Feed Water Heater is sized for the three large coal fired boilers. Consider replacing this unit with one properly sized for the smaller packaged steam boiler system.

Steam Pressure is higher than is needed. Building steam usage is for HVAC and WADF process use. The HVAC utilization pressure is about 40 psig; WADF processes require only 15 psig steam. Consider reducing steam pressure to the minimum needed to serve requirements.

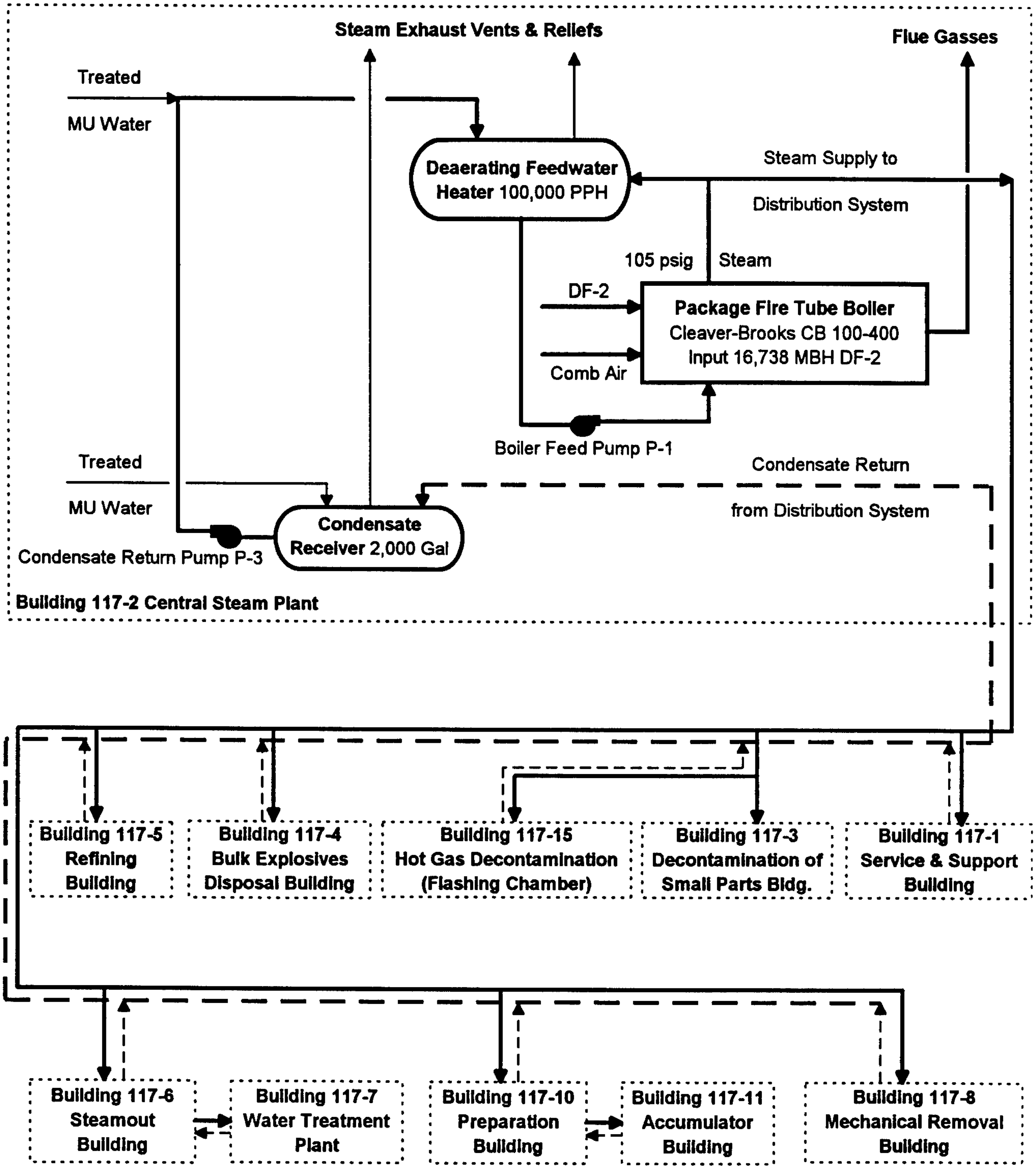
Flue temperature was measured at about 370°F; consider installing a stack economizer system.

Boiler combustion efficiency was measured at only 78%, much lower than is achievable with this type boiler. Consider installation of Automatic Oxygen Trim Combustion Controls or conduct more frequent boiler tune-ups.

Almost no condensate is returned from WADF buildings. Process uses of steam require contact with explosives for most uses, thus, no condensate is returned from them.

HVAC steam usage should provide significant condensate return. Field investigation of condensate return systems in WADF building mechanical room steam pits found only a single system operating; almost every condensate receiver-pump set was found to be non-functional. Consider repairing and/or replacing all the condensate receiver-pump sets.

Figure E-1. WADF Steam Distribution System Schematic Diagram



Central Steam Plant Efficiency (Building 117-2)

Combustion Efficiency measured using a Beckett C5 Oxygen Analyzer; readings:

11.65% Oxygen 375 °F = 78.0% Combustion Efficiency for No. 2 Fuel Oil

In-Plant Losses:

Radiation Losses	-2.50%
Shutdown Losses	-2.00%
Insulation (Convection) Losses	-2.00%
General Condition Losses	-2.00%

Leakage: Several significant steam leaks were observed on exterior steam distribution piping. Most steam traps in non-process applications are not functioning well, and many leaks were observed in building mechanical room steam systems. In addition, only one of the condensate receiver / pump installations is working properly.

Leakage is quantified by observing make-up water and fuel consumption records for the past several months of operations. No processing takes place on most Sundays. The steam boilers are kept on line since they will be needed again in less than 24 hours following the last Saturday shift. Fuel and make-up water useage are shown on Figure E-2 and on Table E-1.

Sunday Make-up Water and Fuel consumption gallons per day from Table E-1 are:

Date/Time	Total Water	Fuel	
~~5-Jun~~	~~130~~	~~647~~	Boiler Plant Shut Down
~~12-Jun~~	~~5,800~~	~~778~~	MU water too high for no processing, heating needed?
19-Jun	4,680	490	
26-Jun	4,030	631	
~~3-Jul~~	~~0~~	~~154~~	Boiler Plant Shut Down
10-Jul	3,960	729	
17-Jul	3,450	639	
24-Jul	4,080	676	
31-Jul	4,320	238	
7-Aug	4,190	559	
~~14-Aug~~	~~5,230~~	~~652~~	MU water too high for no processing, heating needed?
~~21-Aug~~	~~5,240~~	~~650~~	MU water too high for no processing, heating needed?
~~28-Aug~~	~~6,570~~	~~826~~	MU water too high for no processing, heating needed?
~~4-Sep~~	~~2,350~~	~~440~~	MU water too high for no processing, heating needed?
~~11-Sep~~	~~8,700~~	~~1,035~~	MU water too high for no processing, heating needed?

Average Make-up Water:	4,101	gallons/day
Average Fuel Usage:	566	gallons/day

4,101 gallons water is lost daily due to leaks (nic process steam consumption).
6,581 gallons water is consumed daily, on the average, thus, the above loss represents 62.3% of overall water makeup needs. The remainder, about 2,480 gallons per day (average) represents steam consumed for demilitarization processes and for building HVAC uses. Process steam usage consumes the steam without condensate return. Condensate return systems serving building HVAC systems are inoperative. Thus, no condensate is returned to the steam plant. Since the above data is from the non-heating season, the 2,480 gallons per day of makeup water not attributed to leaks is assumed to be process steam consumption.

Efficiency: Based on raw water at 50°F and condensate return normally at 200°F, leakage represents a loss of about 150 BTU/lb. Heat required to produce 105 psig saturated steam from condensate at atmospheric pressure and 200°F is about 985 BTU/lb. Thus loss of the above percentage of condensate represents a boiler plant efficiency loss of: 9.49% .

<u>**Overall Steam Plant Efficiency**</u> =	60.0%	(up to individual building mechanical rooms)
	5.0%	additional losses assumed in each building mechanical room
	55.0%	Used for HVAC system modification evaluations, see Appendix D.

Figure E-2.
Boiler Plant Make-Up Water & Fuel Use (Gallons)
June to September 1994

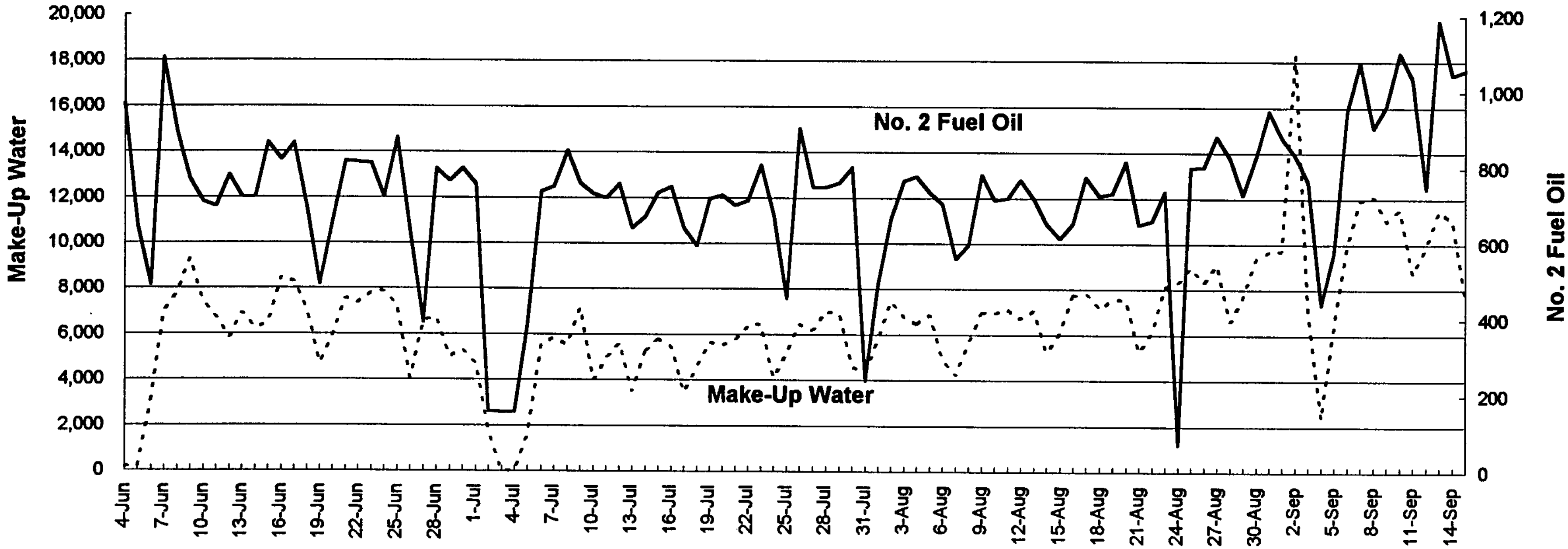


Table E-1. Building 117-2 Boiler Plant Make-Up Water Usage and Fuel Consumption

Date/Time	0400	0530	0700	1230	1630	2000	Total Water	Fuel	Day
4-Jun	30	40	40	30	40	10	190	966	Sat
5-Jun	20	30	10	30	20	20	130	647	Sun
6-Jun	10	30	20	30	1,640	1,360	3,090	488	Mon
7-Jun	1,160	1,620	1,020	1,410	1,050	740	7,000	1,086	Tue
8-Jun	1,210	1,230	1,190	1,740	940	1,490	7,800	892	Wed
9-Jun	1,430	1,220	1,890	2,150	850	1,760	9,300	767	Thur
10-Jun	1,200	1,420	1,280	1,450	620	1,420	7,390	708	Fri
11-Jun	990	1,370	1,170	1,380	680	1,140	6,730	695	Sat
12-Jun	1,140	1,170	790	1,180	680	840	5,800	778	Sun
13-Jun	570	1,190	1,250	880	1,390	1,640	6,920	721	Mon
14-Jun	850	1,130	1,030	2,080	630	530	6,250	720	Tue
15-Jun	1,140	1,400	120	1,200	1,360	1,200	6,420	863	Wed
16-Jun	1,320	1,350	1,100	2,180	1,120	1,390	8,460	818	Thur
17-Jun	1,420	1,410	1,760	950	980	1,790	8,310	862	Fri
18-Jun	1,130	860	1,490	1,490	590	1,480	7,040	692	Sat
19-Jun	610	1,300	610	1,100	270	790	4,680	490	Sun
20-Jun	790	940	970	760	840	1,590	5,890	654	Mon
21-Jun	660	1,560	2,600	2,010	750	-	7,580	816	Tue
22-Jun	1,460	1,150	1,280	870	1,210	1,400	7,370	813	Wed
23-Jun	1,020	1,600	2,440	1,110	1,610	-	7,780	809	Thur
24-Jun	1,080	1,410	1,210	1,170	1,270	1,740	7,880	721	Fri
25-Jun	1,090	1,440	2,070	590	1,430	620	7,240	876	Sat
26-Jun	980	-	-	-	2,510	540	4,030	631	Sun
27-Jun	1,150	510	1,410	810	1,610	1,120	6,610	390	Mon
28-Jun	1,250	1,360	990	1,060	1,140	940	6,740	795	Tue
29-Jun	940	900	670	1,020	590	870	4,990	763	Wed
30-Jun	930	860	1,030	880	630	990	5,320	797	Thur
1-Jul	1,010	950	670	770	570	720	4,690	755	Fri
2-Jul	510	580	480	190	-	-	1,760	158	Sat
3-Jul	-	-	-	-	-	-	0	154	Sun
4-Jul	-	-	-	-	-	-	0	154	Mon
5-Jul	-	-	-	-	400	1,150	1,550	386	Tue
6-Jul	900.00	810	1,200	680	700	1,190	5,480	736	Wed
7-Jul	810	1,140	880	920	980	1,120	5,850	749	Thur
8-Jul	950	1,350	840	640	770	980	5,530	843	Fri
9-Jul	990	1,060	640	3,430	400	630	7,150	758	Sat
10-Jul	890	900	350	810	410	600	3,960	729	Sun
11-Jul	480	640	760	890	1,030	1,130	4,930	718	Mon
12-Jul	650	1,370	1,100	590	1,000	900	5,610	756	Tue
13-Jul	410	600	690	300	560	920	3,480	639	Wed
14-Jul	830	920	780	880	770	1,070	5,250	670	Thur
15-Jul	900	1,050	740	990	880	1,240	5,800	733	Fri
16-Jul	610	1,310	870	990	690	990	5,460	748	Sat
17-Jul	290	1,080	300	670	430	680	3,450	639	Sun
18-Jul	310	890	550	790	960	1,030	4,530	593	Mon
19-Jul	640	1,160	870	970	870	1,150	5,660	717	Tue
20-Jul	730	1,320	810	830	740	1,080	5,510	726	Wed
21-Jul	870	1,110	890	930	840	1,120	5,760	699	Thur
22-Jul	860	1,150	710	1,080	1,060	1,510	6,370	712	Fri
23-Jul	510	1,170	1,250	1,140	750	1,630	6,450	805	Sat
24-Jul	500	900	590	990	330	770	4,080	676	Sun
25-Jul	680	260	850	1,070	1,150	1,150	5,160	455	Mon

Table E-1. Building 117-2 Boiler Plant Make-Up Water Usage and Fuel Consumption

Date/Time	0400	0530	0700	1230	1630	2000	Total Water	Fuel	Day
26-Jul	960	1,250	750	1,230	1,090	1,170	6,450	901	Tue
27-Jul	880	1,350	840	950	1,090	1,070	6,180	749	Wed
28-Jul	860	1,760	880	1,110	1,020	1,380	7,010	747	Thur
29-Jul	890	1,550	1,240	1,160	990	1,090	6,920	759	Fri
30-Jul	610	960	820	940	490	760	4,580	800	Sat
31-Jul	600	1,040	420	900	610	750	4,320	238	Sun
1-Aug	680	890	920	1,080	1,010	1,190	5,770	493	Mon
2-Aug	970	1,750	920	1,070	1,100	1,660	7,470	662	Tue
3-Aug	790	1,380	1,180	930	1,200	1,260	6,740	764	Wed
4-Aug	1,250	1,350	1,330	-	1,030	1,520	6,480	776	Thur
5-Aug	930	1,380	990	1,270	1,430	870	6,870	734	Fri
6-Aug	650	1,210	720	1,000	360	950	4,890	703	Sat
7-Aug	650	1,030	360	840	590	720	4,190	559	Sun
8-Aug	580	930	670	1,100	1,000	1,310	5,590	596	Mon
9-Aug	720	1,450	1,330	1,150	1,010	1,320	6,980	781	Tue
10-Aug	890	1,310	940	1,260	1,000	1,550	6,950	713	Wed
11-Aug	1,070	1,430	1,200	1,500	570	1,350	7,120	720	Thur
12-Aug	1,210	1,570	190	1,320	1,070	1,370	6,730	767	Fri
13-Aug	1,100	1,480	1,040	1,240	920	1,280	7,060	718	Sat
14-Aug	790	1,270	550	1,040	680	900	5,230	652	Sun
15-Aug	470	1,320	770	1,340	1,200	1,000	6,100	613	Mon
16-Aug	1,130	1,280	1,070	1,530	1,210	1,530	7,750	652	Tue
17-Aug	970	1,640	1,170	1,150	1,590	1,310	7,830	775	Wed
18-Aug	910	1,310	1,050	1,410	1,090	1,390	7,160	725	Thur
19-Aug	1,070	1,290	1,280	1,270	1,150	1,500	7,560	733	Fri
20-Aug	1,160	2,880	1,260	1,100	-	1,160	7,560	815	Sat
21-Aug	-	-	2,390	1,300	830	720	5,240	650	Sun
22-Aug	790	1,040	980	850	1,290	1,170	6,120	660	Mon
23-Aug	1,250	1,500	1,190	1,470	1,070	1,620	8,100	737	Tue
24-Aug	1,200	1,870	1,200	1,350	1,420	1,260	8,300	71	Wed
25-Aug	1,270	1,460	1,000	1,790	1,190	2,240	8,950	800	Thur
26-Aug	680	1,570	1,180	1,630	1,330	1,910	8,300	802	Fri
27-Aug	1,150	1,770	1,220	1,560	1,020	2,390	9,110	883	Sat
28-Aug	1,210	1,430	1,020	1,280	670	960	6,570	826	Sun
29-Aug	1,020	1,140	1,310	1,500	1,280	1,430	7,680	728	Mon
30-Aug	1,470	1,730	1,340	1,640	1,110	2,070	9,360	832	Tue
31-Aug	1,160	1,660	1,940	1,650	1,120	2,140	9,670	950	Wed
1-Sep	870	1,870	1,980	1,590	910	2,480	9,700	880	Thur
2-Sep	9,530	420	740	2,160	3,000	2,440	18,290	835	Fri
3-Sep	2,560	550	850	980	2,070	-	7,010	764	Sat
4-Sep	370	360	340	520	390	370	2,350	440	Sun
5-Sep	380	710	890	1,700	1,150	1,610	6,440	577	Mon
6-Sep	260	2,110	1,980	2,050	1,530	2,070	10,000	951	Tue
7-Sep	1,620	2,390	2,470	1,800	1,700	1,930	11,910	1,077	Wed
8-Sep	2,060	2,320	1,780	2,160	2,230	1,540	12,090	906	Thur
9-Sep	2,030	2,120	1,560	2,230	1,450	1,620	11,010	963	Fri
10-Sep	1,810	2,520	1,840	2,410	1,150	1,800	11,530	1,102	Sat
11-Sep	1,410	1,900	2,070	890	890	1,540	8,700	1,035	Sun
12-Sep	1,140	1,560	1,555	2,390	1,700	1,500	9,845	745	Mon
13-Sep	2,000	2,170	2,210	1,550	1,410	2,130	11,470	1,187	Tue
14-Sep	1,490	2,120	2,320	1,670	1,510	1,960	11,070	1,044	Wed
15-Sep	1,800	2,420	1,730	1,760	-	-	7,710	1,057	Thur

Table E-2. Summary of Central Steam Plant and Distribution System Energy Conservation Opportunities

Description of Energy Conservation Opportunity	Energy Savings: Electric kWH/Yr	Energy Savings: Fuel Oil Million BTU/Yr	Energy Cost Savings: Electric $/Year	Energy Cost Savings: Fuel Oil $/Year	Energy Cost Savings: Energy $/Year	Energy Cost Savings: Energy LCC$	O & M Savings: Savings $/Year	O & M Savings: Savings LCC$	Total Savings: Annual $/Year	Total Savings: Life Cycle LCC$
Central Steam Plant and Distribution System Energy Conservation Opportunities										
Replace Building Condensate Return Systems	0	1,100	$0	$6,743	$6,743	$95,957	$0	$0	$6,743	$95,957
Reduce Steam Pressure, Install New Deaerator, and Repair Steam Leaks	0	21,218	$0	$130,030	$130,030	$1,850,332	($2,714)	($32,402)	$115,725	$1,687,577
	Note: This ECO includes equipment replacement costs at 5 and 10 years at present value of:									$57,961
Install Oxygen Trim Combustion Controls & Flue Economizer	(8,009) (0.91)kW	1,435	($444)	$8,792	$8,348	$119,770	($2,501)	($29,856)	$5,847	$89,914
Summary Central Steam Plant Energy Conservation Opportunities	(8,009)	23,753	($444)	$145,565	$145,121	$2,066,059	($5,214)	($62,258)	$128,315	$1,873,447

Description of Energy Conservation Opportunity	Retrofit Investment $	Economic Analysis: SIR	Economic Analysis: Payback Years
Replace Building Condensate Return Systems	$64,200	1.49	9.52
Reduce Steam Pressure, Install New Deaerator, and Repair Steam Leaks	$202,624	8.33	1.75
Install Oxygen Trim Combustion Controls & Flue Economizer	$60,280	1.49	10.31
Summary Central Steam Plant Energy Conservation Opportunities	$327,104	5.73	2.55

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY97

Replace Condensate Receiver / Return Pump Sets in WADF Buildings,
Reduce Steam Pressure, Install New Deaerator, and Repair Steam Leaks, &
Install Flue Economizer and Oxygen Trim Combustion Controls

Analysis Date: November 1994 Economic Life: 15 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$292,057		
B. SIOH	$ 17,523		
C. Design Cost	$ 17,523		
D. Total Cost (1A+1B+1C)	$ 327,104		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$327,104

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	(27.33)		($350)	12.02	($4,212)
B. Dist	$6.13	23,753		$145,565	14.23	$2,071,394
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	(0.9)	kW	($93)	12.02	($1,123)
F. Total		23,725		$145,121		$2,066,059

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($5,214)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($62,258)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	($57,961)	5	0.863	($50,020)
b.	($57,961)	10	0.744	($43,123)
c.	($57,961)	15	0.642	($37,211)
d. Total	($173,882)			($130,354)

C Total Non Energy Discounted Savings (3A2+3Bd4) ($192,611)

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$128,315	
5. Simple Payback (1G/4):	2.55	Years
6. Total Net Discounted Savings (2F5+3C):	$1,873,447	
7. Savings to Investment Ratio (SIR) 6/1G:	5.73	

WADF Building HVAC System Condensate Return System Replacement

HVAC energy usage is estimated for selected WADF buildings in Appendix D where HVAC control system, building envelope and heat recovery energy saving projects are evaluated. Results of these simulations are:

Building Number	Description	Electric kWH/Yr	Fuel Oil k BTU/Yr	Includes consideration of the following ECOs with SIRs > 1
117-1	Services & Supply	91,447	639,767	DDC Controls Retrofit
117-2	Central Heating Plant	NA	NA	NA
117-3	Decontamination of Small Parts	104,029	1,060,060	DDC Controls Retrofit
117-4	Bulk Explosives Disposal	69,400	783,096	DDC Controls Retrofit
117-5	Refining Building	90,697	868,975	DDC Controls, Ht Recovers & Air Curtains
117-6	Steamout Building	152,601	1,470,778	DDC Controls, Ht Recovers & Air Curtains
117-6A	Water Booster Pump Building	NA	NA	NA
117-7	Process Water Treatment Building	NA	NA	NA
117-8	Mechanical Removal Building	60,908	609,765	DDC Controls Retrofit
117-10	Preparation Building	78,614	1,316,319	DDC Controls Retrofit
117-11	Accumulator Building	Included with 117-10 results		
117-15	Flashing Chamber	NA	NA	NA
Total Estimated HVAC Energy Usage		**647,695**	**6,748,760**	**with successful HVAC ECOs**

HVAC Fuel Oil consumption includes losses from condensate that could have been returned to the central steam plant, but is not because of inoperative equipment.

The plant efficiency used to determine the above heating energy use: 55%
Thus, the heating load, or steam energy consumption is: 3,712 Million BTU/Year.

Steam is distributed at 105 psig, is reduced through pressure regulating valves to 40 psig and is then condensed in heat exchangers to heat a water-ethylene glycol mixture for circulation through heating coils and convectors. Enthalpies of the steam, condensate and raw water are as follows:

	Total enthalpy		h_{f-g}
Saturated steam, 105 psig =	1,190	BTU/Lb	878
Saturated Steam, 40 psig =	1,176	BTU/Lb	920
Liquid, 200°F =	168	BTU/Lb	
Liquid, 50°F =	18	BTU/Lb	

Steam generated to satisfy the HVAC heating loads is: 4,034,585 Pounds per Year.
Heat lost from condensate <u>not</u> returned is, thus: 605 Million BTU/Year

Equivalent fuel consumption, per existing boiler efficiency 1,100 Million BTU/Year No. 2 Fuel Oil

Electric usage is assumed to remain the same as existing because existing condensate receiver-pump systems are energized, but are leaking into the steam pit sump. A small amount of additional electric power consumption is expected, however, it is not likely to be significant.

Operations and maintenance expenses are expected to be the same as for the existing system.

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY97

Replace Condensate Receiver / Return Pump Sets in WADF Buildings

Analysis Date: November 1994 Economic Life: 15 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$57,322		
B. SIOH	$ 3,439		
C. Design Cost	$ 3,439		
D. Total Cost (1A+1B+1C)	$ 64,200		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$64,200

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	0.0	$0	12.02	$0
B. Dist	$6.13	1,100	$6,743	14.23	$95,957
C. LPG	-	-			
D. Other	-	-			
E. Elec Demand	$102.21				
F. Total		1,100	$6,743		$95,957

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.		0	1.00	$0
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$6,743	
5. Simple Payback (1G/4):	9.52	Years
6. Total Net Discounted Savings (2F5+3C):	$95,957	
7. Savings to Investment Ratio (SIR) 6/1G:	1.49	

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared November-94	Sheet 1 of 1
Project ECIP Facility Energy Improvements	Project No.	Basis for Estimate Code A (no design competed)
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada		
Engineer-Architect Keller & Gannon		
Drawing No. Replace Condensate Return Systems	Estimator B. I. Horst	Checked By R. C. Lennig

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Simplex Condensate Return System, pump, motor, float switch, controls, cast iron receiver	14	EA	$609	$8,533	$1,099	$15,379	$23,912
Duplex Condensate Return System, 2 pumps, motors, float switch, alternator assembly, cast iron rcvr	1	EA	$1,219	$1,219	$2,953	$2,953	$4,172
Miscellaneous Piping and Insulation Repairs, per System	15	EA	$609	$9,142	$203	$3,044	$12,186
Subtotal				$18,894		$21,377	$40,271
Nevada Sales Tax	3.75%	%		-		$802	$802
Subtotal							$41,073
Contractor OH & Profit	25.0%	%					$10,268
Subtotal							$51,341
Bond	1.5%	%					$770
Subtotal							$52,111
Estimating Contingency	10.0%	%					$5,211
Total Probable Construction Cost							**$57,322**

Building Number	Description	Simplex	Duplex
117-1	Services & Supply	2	-
117-2	Central Heating Plant	-	-
117-3	Decontamination of Small Parts	2	-
117-4	Bulk Explosives Disposal	2	-
117-5	Refining Building	-	1
117-6	Steamout Building	4	-
117-6A	Water Booster Pump Building	-	-
117-7	Process Water Treatment Building	-	-
117-8	Mechanical Removal Building	2	-
117-10	Preparation Building	2	-
117-11	Accumulator Building	-	-
117-15	Flashing Chamber	-	-
	Totals	**14**	**1**

Reduce Central Boiler Plant Steam Pressure & Install Properly-Sized Deaerator (Including Distribution System Leak Repairs)

Deaerating Feedwater Heater

The deaerating feed water heater now in use is sized for the three large coal fired boilers. Sodium sulfite is added to scavenge oxygen from boiler feed water.

168	Lbs Na_2SO_3 was added to boiler makeup water during the period:					
1-Feb-94	through	1-Sep-94	212 days, with	6,645	gallons average makeup / day;	
1,408,719	gallons total in above period, or		9.1	ppm by weight SO_3 overall.		

A residual of 20 ppm SO_3, as stated in the DZB letter of 5 October 1994, even without any dissolved O_2 needs 371 Lbs Na_2SO_3 during the period.

Other water treatment chemicals used for the boiler feedwater treatment during this period include:

22.65	Gallons Phosphorus
20.50	Gallons Lye
94.50	Gallons Polymer

Raw water common ion analyses indicate hardness of 152 ppm (analysis of building 117-1 cold water on 12 March 1992).

In addition, the existing deaerating feedwater heater is far oversized for the packaged boiler:

The packaged boiler can generate about 13,400 PPH of steam.

The deaerating feedwater heater is sized for 100,000 PPH of throughput.

Based on sizing alone, the package steam boiler can service either the deaerating feedwater heater or the steam load, but not both.

Conclusion: Chemicals usage for oxygen control in the boiler feed water (BFW) is insufficient.
Chemicals usage for softening BFW is insufficient.
Once through system (with almost 100% make-up) requires better water treatment

Recommendation: Clean scale from boiler water side immediately. Scaling is most likely already causing operating problems and may endanger the boiler's future operation.

Reduce Operating Steam Pressure

The operating steam pressure is higher than is needed. Building steam usage is for HVAC and WADF process use. The HVAC utilization pressure is about 40 psig; WADF processes require only 15 psig steam. Reduce the steam pressure to the minimum required to serve these requirements.

During field investigations, the steam pressure at Building 117-8, the building farthest from the central steam plant, was observed to be about 80 psig (based on existing pressure gauge). Assuming that this pressure is accurate, the system provides for about 25 psig of pressure drop from the steam plant to the farthest point of use.

	Operating Pressure Requirements				Reduced System
Operating Period	Months	HVAC	Process	Maximum	Operating Pressure
Winter Heating Season	Oct - May	38 psig	15 psig	38 psig	63 psig
Summer Non-heating Season	Jun - Sep	NA	15 psig	15 psig	40 psig

Energy savings calculations due to reduced operating pressures are based on the following:

	Total enthalpy of steam		h_{f-g}
Saturated steam, 105 psig =	1,190	BTU/Lb	878
Saturated steam, 63 psig =	1,183	BTU/Lb	902
Saturated Steam, 40 psig =	1,176	BTU/Lb	920
Liquid, 200°F =	168	BTU/Lb	
Liquid, 50°F =	18	BTU/Lb	

Existing Energy Consumption, including: Recommended HVAC Control, Exhaust Heat Recovery and Air Curtain Retrofits and Repairs to HVAC Steam Condensate Return Systems

Steam Plant Efficiency (Baseline):		55.0%
HVAC System Requirements		
HVAC Steam LOAD, with HVAC ECOs Implemented:	3,712	Million BTU/Year
Steam Needed at 40 psig to satisfy load:	4,034,585	Pounds Steam/Year
Heat required from boiler with condensate system repaired, 105 psig:	**4,123**	**Million BTU/Year**
Process Steam Requirements		
Steam requirements based on Make-up Water Records:	20,705	Lbs/Process-Day
Process Days per Year assuming Sundays-only off:	313	Process-Days/Year
Process Steam Requirements:	6,480,509	Pounds/Year
Heat required at present operating steam pressure (105 psig):	**7,595**	**Million BTU/Year**
Steam Leaks in Distribution System		
Steam Loss due to leaks in distribution piping:	34,247	Pounds/Day
Days per year of boiler operations (including non-processing days)	365	Days/Year
Steam Losses:	12,500,129	Pounds/Year
Heat required at present operating steam pressure (105 psig):	**14,650**	**Million BTU/Year**
Total Steam Heat Required	26,369	Million BTU/Year
Equivalent No. 2 Fuel Oil Consumption (corrected for leakage):	**37,941**	**Million BTU/Year**

Future Energy Consumption, including: Repairs of Steam Distribution System Leaks, Installation of a Proper-Sized Deaerating Feedwater Heater & Operations at Reduced Steam Pressures

Steam Plant Efficiency with leaks repaired (see Efficiency Calculations):		64.5%
HVAC System Requirements		
HVAC Steam LOAD, with HVAC ECOs Implemented:	3,712	Million BTU/Year
Steam Needed at 40 psig to satisfy load:	4,034,585	Pounds Steam/Year
Heat required from boiler with condensate system repaired, 63 psig:	**4,095**	**Million BTU/Year**
Process Steam Requirements		
Steam requirements based on Make-up Water Records:	20,705	Lbs/Process-Day
Process Days per Year assuming Sundays-only off:	313	Process-Days/Year
Process Steam Requirements:	6,480,509	Pounds/Year
Heat required at reduced operating pressure (63 psig - Winter):	3,775	Million BTU/Year
Heat required at reduced operating pressure (40 psig - Summers):	3,752	Million BTU/Year
Total Heat required at reduced operating pressures:	**7,527**	**Million BTU/Year**
Steam Leaks in Distribution System		
Steam Loss due to leaks in distribution piping (assumed repaired):	**0**	**Million BTU/Year**
Total Steam Heat Required	11,622	Million BTU/Year
Equivalent No. 2 Fuel Oil Consumption (corrected for leakage):	**16,723**	**Million BTU/Year**

No. 2 Fuel Oil Savings from repairs of leaks, new deaerator and reduced steam operating pressures:	**21,218**	**Million BTU/Year**

Note: Fuel oil consumption estimated for these repairs and system upgrades is based on operation of WADF facilities two shifts per day, six days per week, year-round. This is the current schedule (Fall 1994), however, it is subject to change depending on the level of activity required.

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Reduce Steam Pressure, Install New Deaerator, and Repair Steam Leaks
Analysis Date: November 1994 Economic Life: 15 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$180,914		
B. SIOH	$ 10,855		
C. Design Cost	$ 10,855		
D. Total Cost (1A+1B+1C)	$ 202,624		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$202,624

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	0.0	$0	12.02	$0
B. Dist	$6.13	21,218	$130,030	14.23	$1,850,332
C. LPG	-	-			
D. Other	-	-			
E. Elec Demand	$102.21				
F. Total		21,218	$130,030		$1,850,332

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($2,714)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($32,402)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	($57,961)	5	0.863	($50,020)
b.	($57,961)	10	0.744	($43,123)
c.	($57,961)	15	0.642	($37,211)
d. Total	($173,882)			($130,354)

C Total Non Energy Discounted Savings (3A2+3Bd4) ($162,755)

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$115,725	
5. Simple Payback (1G/4):	1.75	Years
6. Total Net Discounted Savings (2F5+3C):	$1,687,577	
7. Savings to Investment Ratio (SIR) 6/1G:	8.33	

CONSTRUCTION COST ESTIMATE				Date Prepared: November-94		Sheet 1 of 1	
Project: ECIP Facility Energy Improvements				Project No.	Basis for Estimate: Code A (no design competed)		
Location: Western Area Demilitarization Facility (WADF), Hawthorne Army Ammunition Plant, Nevada							
Engineer-Architect: Keller & Gannon							
Drawing No. Steam Leak Repairs, New Deaerator & Lower Steam Pressures		Estimator: B. I. Horst			Checked By: R. C. Lennig		

Line Item	Quantity: No. Units	Quantity: Unit Meas.	Labor: Per Unit	Labor: Total	Material: Per Unit	Material: Total	Total Cost
Deaerating Feedwater Heater Retrofit							
Deaerating Feedwater Heater for Cleaver Brooks Steam Boiler	1	EA	$15,000	$15,000	$35,000	$35,000	$50,000
Pipe - Deaerating Feedwater Heater: 4-inch Dia Sch 80 Welded Steel	250	LF	$16.51	$4,127	$10.10	$2,526	$6,653
Pipe - Deaerating Feedwater Heater: 2-inch Dia Sch 80 Welded Steel	100	LF	$10.01	$1,001	$4.49	$449	$1,450
Steam Pressure Controller & Interface							
Steam Pressure Sensor	1	EA	$67	$67	$873	$873	$940
P/E Relay	1	EA	$55	$55	$130	$130	$185
Auxilliary Contact	1	EA	$50	$50	$350	$350	$700
DDC Control Unit - 16 Point	1	EA	$500	$500	$2,500	$2,500	$3,000
Miscellaneous Steam Distribution Piping Leak Repairs							
Steam Main 14-inch "Spool" on 10-inch line, replace flange & gaskets	1	EA	$271	$271	$150	$150	$421
Steam Control Valve, 4-inch Flanged, Iron Body	2	EA	$122	$122	$1,577	$3,154	$3,276
Replace Ball-Expansion Joints, Steam Piping, 10-inch Steam	10	EA	$125	$1,254	$1,871	$18,711	$19,965
Replace Ball-Expansion Joints, Steam Piping, 6-inch	10	EA	$79	$790	$1,096	$10,959	$11,749
Labor and Materials for steam piping miscellaneous repairs	500	MH	$42.33	$21,165	$14.11	$7,055	$28,220
Subtotal				$44,402		$81,857	$126,560
Nevada Sales Tax	3.75%	%		-		$3,070	$3,070
Subtotal							$129,629
Contractor OH & Profit	25.0%	%					$32,407
Subtotal							$162,037
Bond	1.5%	%					$2,431
Subtotal							$164,467
Estimating Contingency	10.0%	%					$16,447
Total Probable Construction Cost							**$180,914**

For Life Cycle Cost Analysis, assume steam piping leak repairs must be performed every five years. These costs are expensed each five years in the Life Cycle Cost Analysis Summary. **$57,961**

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year: **$2,714** per year.

Install Oxygen Trim Combustion Controls <u>and</u> Boiler Flue Economizer on Fire-Tube Boiler to Preheat Boiler Feedwater

Based on field measurement of combustion efficiency and on conversations with the boiler representative (R.F. McDonnald), the existing Cleaver-Brooks Fire-Tube Steam Boiler is not properly trimmed.

The high oxygen content in the flue gasses results in wasteful operation and a low stack temperature. The boiler burner should be retrimmed to about 7% oxygen (rather than the measured 11.65% oxygen) at low fire. Such retrimming will increase the existing stack temperature from 375°F to about 440°F.

The combustion efficiency will be improved from the current 78.0% to about 79.9% which is about a 1.9% improvement. Increasing the steam plant efficiency to 71.4% overall, from an efficiency of about 69.5% assumed after implementation of the energy conservation opportunities involving repairing leaks, reducing steam pressure and installing a properly sized deaerator.

Installation of a stack economizer to recover additional heat to preheat cold makeup water will improve the steam system efficiency an additional 6.7% according to the manufacturer's representative, based on a computer simulation at the low firing rate. The improved steam plant efficiency will, thus be about 78.1% .

Fuel Oil Consumption after leak repairs, new deaerator and steam pressure reduction:	16,723	Million BTU/Year
Revised Annual Fuel Oil Consumption is thus:	15,288	Million BTU/Year
Fuel Oil Savings from Economizer & Oxygen Trim:	**1,435**	**Million BTU/Year**

The circulation pump used for heat recovery will be operated continuously. Based on the manufacturer's system sizing calculations, the flue economizer is sized for a 36 gpm flow rate, with as high as a 4.2 ft head loss. Assuming a 60% efficient circulation pump, about a 1/2 HP motor is required. Electrical requirements are: 8,009 kWH/Year, or 27.3 Million BTU/Year equivalent
This corresponds to 0.91 kW additional electric demand.

Operation and Maintenance

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year for replacing worn components, plus 40 manhours per year for periodic adjustments and calibrations.

Assuming a plumbers rate from Means '94, location adjusted, the annual O&M expenses are estimated at: **$2,490** per year.

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada
Project Title: ECIP Facility Energy Improvements Fiscal Year FY97
Install Flue Economizer and Oxygen Trim Combustion Controls
Analysis Date: November 1994 Economic Life: 15 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$53,821		
B. SIOH	$ 3,229		
C. Design Cost	$ 3,229		
D. Total Cost (1A+1B+1C)	$ 60,280		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$60,280

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	(27.3)	($350)	12.02	($4,212)
B. Dist	$6.13	1,435	$8,792	14.23	$125,105
C. LPG	-	-			
D. Other	-				
E. Elec Demand	$102.21	(0.9) kW	($93)	12.02	($1,123)
F. Total		1,407	$8,348		$119,770

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($2,501)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($29,856)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4) ($29,856)

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)): $5,847
5. Simple Payback (1G/4): 10.31 Years
6. Total Net Discounted Savings (2F5+3C): $89,914
7. Savings to Investment Ratio (SIR) 6/1G: 1.49

F:\PROJ\1640316\ENGR\STM-ECOS.XLS LC-Oxygen Trim & Economizer

CONSTRUCTION COST ESTIMATE	Date Prepared November-94	Sheet 1 of 1
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate: Code A (no design competed)
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada		
Engineer-Architect: Keller & Gannon		
Drawing No.: Retrofit Flue Economizer & Oxygen Trim Combustion Controls	Estimator: B. I. Horst	Checked By: R. C. Lennig

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Oxygen Trim Combustion Control Retrofit onto Existing Cleaver-Brooks Boiler							
Oxygen Trim Combustion Control Retrofit Package	1	EA	$1,500	$1,500	$15,000	$15,000	$16,500
Flue Economizer Heat Recovery Package							
Thermostack Waste Heat Reclaim Unit, Model TS-130	1	EA	$2,000	$2,000	$9,000	$9,000	$11,000
Oper Unit Package, including Pump, T&P Relief, Valves, Thermostat, etc.	1	EA	$237	$237	$556	$556	$793
Steel Pipe, 1-1/2", Schedule 80 including 10% allowance for fittings	200	LF	$13.26	$2,651	$3.96	$791	$3,442
Fiberglass Insulation, 1-1/2" Wall, 1-1/2" Pipe, All Service Jacket	200	LF	$4.59	$917	$1.64	$327	$1,244
Aluminum Jacket, 0.016"	196	SF	$5.10	$1,001	$0.56	$110	$1,111
Circulating Pump: 1/2 HP	2	EA	$152	$305	$1,181	$2,362	$2,667
Wiring & Conduit	80	LF	$5.16	$412	$1.90	$152	$564
Motor Starter (Mechanical Room)	1	EA	$83	$83	$94	$94	$177
Subtotal				$9,107		$28,392	$37,500
Nevada Sales Tax	3.75%	%		-		$1,065	$1,065
Subtotal							$38,564
Contractor OH & Profit	25.0%	%					$9,641
Subtotal							$48,205
Bond	1.5%	%					$723
Subtotal							$48,929
Estimating Contingency	10.0%	%					$4,893
Total Probable Construction Cost							**$53,821**

FACSIMILE TRANSMITTAL SHEET

FAXED 12/6/94

R. F. MacDONALD CO.
371 Foster City Blvd.
Foster City, CA 94404
(415) 574-0110 - FAX (415) 574-1007

DATE REC'D:
TIME REC'D: 3:19 pm
PROJECT No.:
ORIGINAL: BTH :/FILE
COPY: TMR

TO: Keller & Gannon DATE: 12/6/94

ATTN: Blair Horst FROM: ROBERT F. MacDONALD

REF: Army Ammunition FAX: 864-3681

Plant Hawthorne, Nevada

Modifications to existing steam plant

Existing boiler - Cleaver Brooks
Model CB 100-400-150# steam
Unit #L89956 - 400 HP, #2 oil fired

Budget prices for:

Economizer - Thermostak
Model ~~130~~ TS-130 $9000.00

Cleaver Brooks O_2 Trim
systems $15,000.00

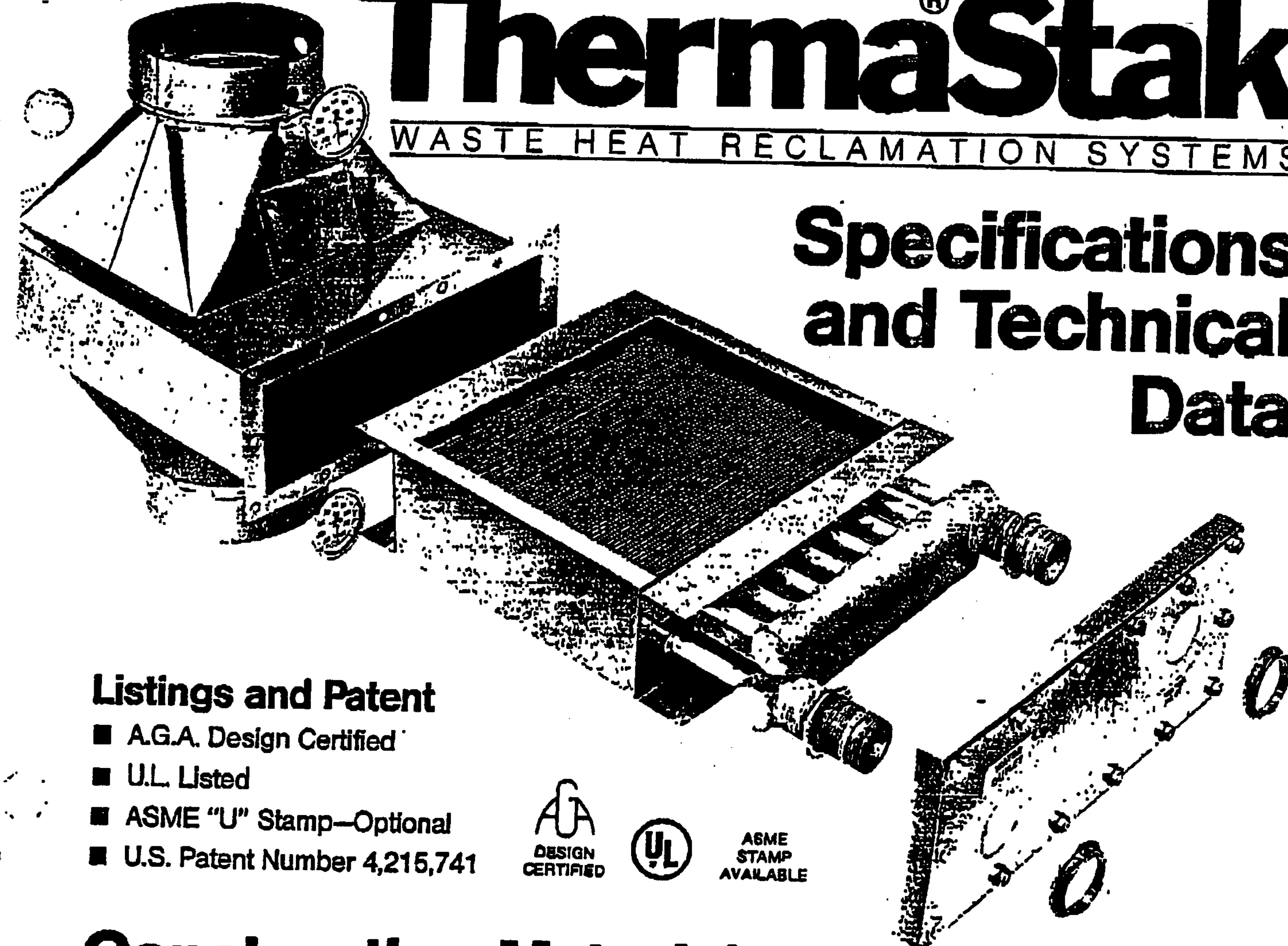
Packaged Deaerator Model
SM15P w/ 2 boiler feed pumps $35,000
If all existing BF pumps
can be used deduct $6000.00 (for 2)

TOTAL NUMBER OF PAGES 7 (INCLUDING COVER SHEET)

ThermaStak®

WASTE HEAT RECLAMATION SYSTEMS

Specifications and Technical Data

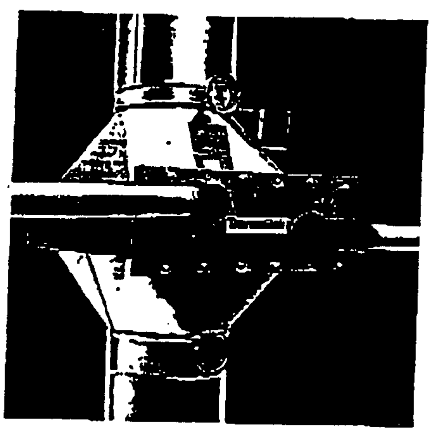


Listings and Patent

- A.G.A. Design Certified
- U.L. Listed
- ASME "U" Stamp—Optional
- U.S. Patent Number 4,215,741

DESIGN CERTIFIED UL ASME STAMP AVAILABLE

Construction Materials



Heat Exchanger

Tubing
⅝" O.D., 0.035" wall seamless copper tube SB-111-80 alloy 122. (Limited to 900°F exhaust temp.).

Headers
Seamless copper tubing type L ASTM B-88 alloy C12200
1" nominal—1⅛" O.D., 0.05" wall thickness
1½" nominal—1⅝" O.D., 0.06" wall thickness
2" nominal—2⅛" O.D., 0.07" wall thickness

Connections
NPT fittings in accordance with ANSI B 16.22

Fins
0.0085" thick, copper CDA 110, ASTM B 152
Tube holes extruded and flared for positive fin spacing.
1½" triangular staggered fin pattern

Coatings (Available Upon Request)
Electroless nickel coating for corrosion resistance. (Limited to 1100°F exhaust temp.).
Heresite coating. (Limited to 425°F exhaust temp.).

Housings
Standard (TS-010-080) 22 gauge, AISI type
304 2B stainless steel.
Heavy (TS-100-150) 18 gauge, AISI type
304 2B stainless steel *or*
0.1345 10 gauge, cold rolled steel, AISI 1008 or 1010.

Dimensions/Operating Specifications

	Model No.	Flue Diameter (Inches)	Overall Dimensions (Inches) Height	Width	Length	Barometric Unit Heights	Water Connections (Inches)	Flow Rate (GPM) Min.	Max.	Heat Transfer Area (Ft²)	Water Capacity (Gal.)	Shipping Weight (Lbs.)
One Row Units	TS-010+	6	20.5	12.5	16.5	28.2	1	5	10	9.4	0.2	64
	TS-015+	8	25.5	15.5	19.5	30.0	1	6	12	21.9	0.3	76
	TS-018	10	20.5	15.5	19.5	29.5	1.5	6	14	21.9	0.4	87
	TS-020+	10	25.5	18.5	22.5	33.0	1.5	8	18	34.2	0.5	90
	TS-0M1+	12	25.5	21.5	25.5	34.0	1.5	9	21	49.3	0.5	120
	TS-0M2+	16	28.5	27.5	31.5	39.5	1.5	12	28	87.8	0.7	200
	TS-0M3+	20	32.5	33.5	37.5	45.0	1.5	15	30	137.2	1.0	240
	TS-048+	24	29.0	39.5	43.5	51.5	1.5	18	30*	197.6	1.3	311
	TS-080+	28	28.5	45.5	50.0	50.5	2.0	21	49	268.8	1.8	410
Two Row Units	TS-025	8	25.5	16.5	19.5	30.0	1.5	12	28	33.6	0.8	92
	TS-030	10	25.5	18.5	22.5	33.0	1.5	15	30	52.4	0.9	106
	TS-035	12	25.5	21.5	25.5	34.0	1.5	18	30	75.4	1.1	135
	TS-045	16	28.5	27.5	31.5	39.5	1.5	24	30*	134.4	1.5	220
	TS-060	20	32.5	33.5	37.5	45.0	2.0	30	60	210.0	2.0	272
	TS-105	24	29.0	39.5	44.0	CF	2.0	36	60*	302.2	3.0	CF
	TS-125	28	28.5	45.5	50.0	CF	2.0	42	60*	411.3	3.8	CF
Three Row Units	TS-040	12	28.5	21.5	25.5	CF	1.5	9	21	113.2	1.1	153
	TS-055	16	31.5	27.5	31.5	CF	1.5	12	28	201.4	1.8	222
	TS-110	20	35.5	33.5	38.0	CF	2.0	15	35	314.8	3.0	CF
	TS-130	24	32.0	39.5	44.0	CF	2.0	18	42	453.4	4.0	CF
	TS-145	28	31.5	45.5	50.0	CF	2.0	21	49	616.9	5.2	CF
Four Row Units	TS-050	12	28.5	21.5	25.5	CF	1.5	18	30*	150.9	1.5	173
	TS-100	16	31.5	27.5	32.0	CF	2.0	24	56	268.5	2.6	CF
	TS-120	20	35.5	33.5	38.0	CF	2.0	30	60*	434.2	3.8	CF
	TS-140	24	32.0	39.5	44.0	CF	2.0	36	60*	604.5	5.5	CF
	TS-150	28	31.5	45.5	50.0	CF	2.0	42	60*	822.5	7.0	CF

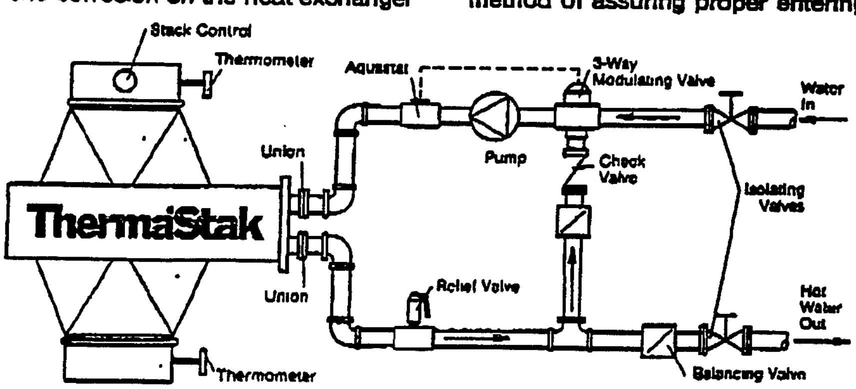
*Higher flow rates possible on these models. CF Consult Factory.

+AGA design certified models. Acceptable for use with atmospheric burners.

Standard package includes: ■ Two stack thermometers ■ Automatic thermastat pump control ■ Temperature/ pressure relief valve ■ Balancing valve ■ 22 gauge stainless casing (10-80) ■ 10 gauge carbon steel casing (100-150) ■ Copper coil and fins ■ Instruction booklet

Cold Entering Water Conditions

The inlet water to the ThermaStak Waste Heat Reclamation System must be maintained at certain minimum temperatures to prevent cold end corrosion on the heat exchanger surface. These minimum temperatures are 105°F for natural gas and 160°F for No. 2 fuel oil. The piping schematic below is the recommended method of assuring proper entering water temperatures. Please consult the factory for 3-way valve specifications.



Aquastat should be set so that:

1. For natural gas the entering water is 105°F or more.
2. For No. 2 fuel oil the entering water is 160°F or more.
3. Minimum aquastat dead band 20°F.

R=98% 415 574 1007 12-06-94 03:19PM P003 #31

Reliable O_2 Trim Systems Are Offered by Many... But Delivered by Cleaver-Brooks

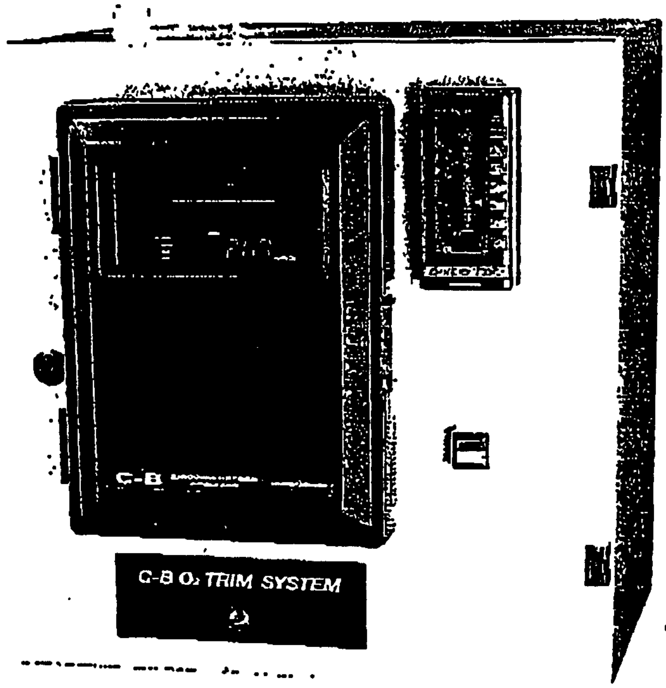
C-B O_2 TRIM SYSTEM

Cleaver-Brooks offers the C-B O_2 Trim System — a complete package to control and maintain optimum fuel-to-air ratio and maximum fuel efficiency.

The System's proven dependability has been ecorded in thousands of installations worldwide. With advanced technology and outstanding features, the C-B O_2 Trim System delivers reliable monitoring and exceptional control of O_2 concentrations.

The C-B O_2 Trim System is designed to be easily maintained on site.

Money-Saving Feature: The new O_2 Trim System — on a typical application — can save up to 2% in annual fuel cost due to ɿreater efficiency. This ɩs accomplished by adjusting either the air or gas levels to achieve optimum firing.



ANALYZER

The C-B Zirconia Oxygen Analyzer uses a direct *in situ* method of analyzing flue gas; making it the fastest reacting, most accurate, and reliable method available. The large LED display continuously informs the operator of the current O_2 level and other flue gas information. An optional stack temperature transmitter enables the analyzer to compute and display combustion efficiency.

Money-Saving Feature: The analyzer diagnostics predict the remaining cell life of the Zirconia Cell. The cell can be serviced on-site while the boiler is in use, not interrupting boiler system uptime.

PROBE

The probe is the basic component of the analyzer. The C-B Probe has undergone refinements and improvements based on years of experience and wide-ranging application. Its superior stability and reliability will provide years of trouble-free performance.

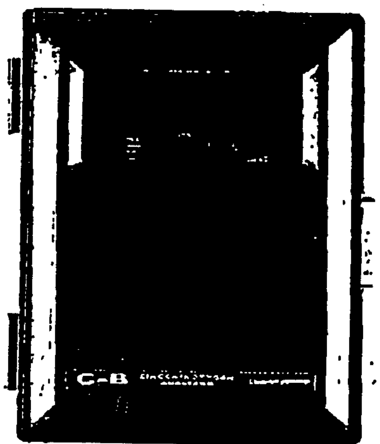
Features:

- Easily replaced long-lasting cell
- Built-in reference junction
- Fast response
- Heavy-duty heater and thermocouple
- No aspiration required

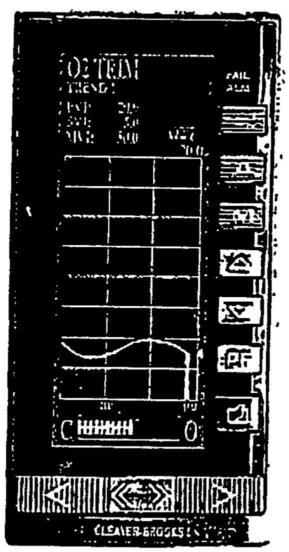
CONTROLLER

The microprocessor-based controller indicates the percentage of O_2 at set point and output in both digital and bar graph formats. Operation and system adjustments are made from a menu on the front panel display. The display also includes graphs for viewing trend logs.

Cleaver-Brooks®



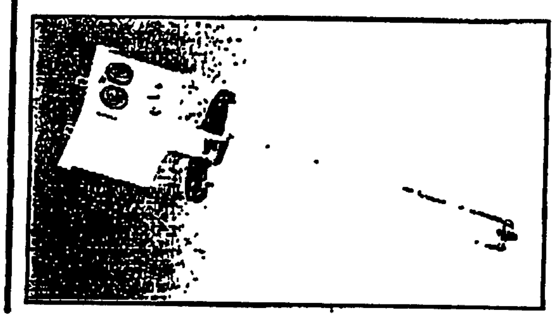
Analyzer
with self diagnostics and large easy-to-read display of calibrated information.



Controller
indicates oxygen set point curve as well as O_2 trend.

C-B O_2 TRIM SPECIFICATION

PROBE	
Sample Gas Temperature:	0 to 1100°F.
Insertion length:	15.75", 27"
Ambient Temperature:	14 to 176°F.
Material in contact with gas:	Stainless Steel, Zirconia
Installation:	Flange mounting (equivalent to 2" 150 lbs FF ANSI flange)
Enclosure:	NEMA 4
Weight:	Insertion length 15.75" appr. 9 lbs Insertion length 27" appr. 12 lbs
CONTROL PANEL	
Power Supply:	110/120 VAC, 3 Amps, 50/60 Hz
Dimensions:	20" H x 20" W x 13" D
Weight:	Appr. 70 lbs
Ambient Temperature:	32 to 122°F.
Air Supply:	25-125 psig instrument air dry, oil free
Outputs:	
Control:	3-15 psig
Recorder:	O_2 value 1-5 VDC or 4-20 mA DC Firing Rate 1-5 VDC
Contact:	250 VAC 2 Amps Low O_2 alarm Low O_2 shutdown
Indication:	Oxygen level 0.0 to 100 Vol % Set point 0-14% O_2 Control output 0-100% Fuel selection
Calibration:	Automatic one point Manual two point 10-segment set point curves for oil and gas Local or remote fuel selection
Other features:	Oxygen cell life span prediction/Self diagnostics Variable response at different firing rates Integral only response on set point change Trim fuel or air Eight preset responses to simplify tuning Oxygen trend display
Options:	Flue gas temperature efficiency indication Stand Stack Probe Adapters



Zirconia Probe
with easily interchangeable cell. It is available with special stack adapter kit and/or extended length.

Authorized Sales, Service, and Parts Worldwide

Cleaver Brooks®

Division of Aqua-Chem, Inc.
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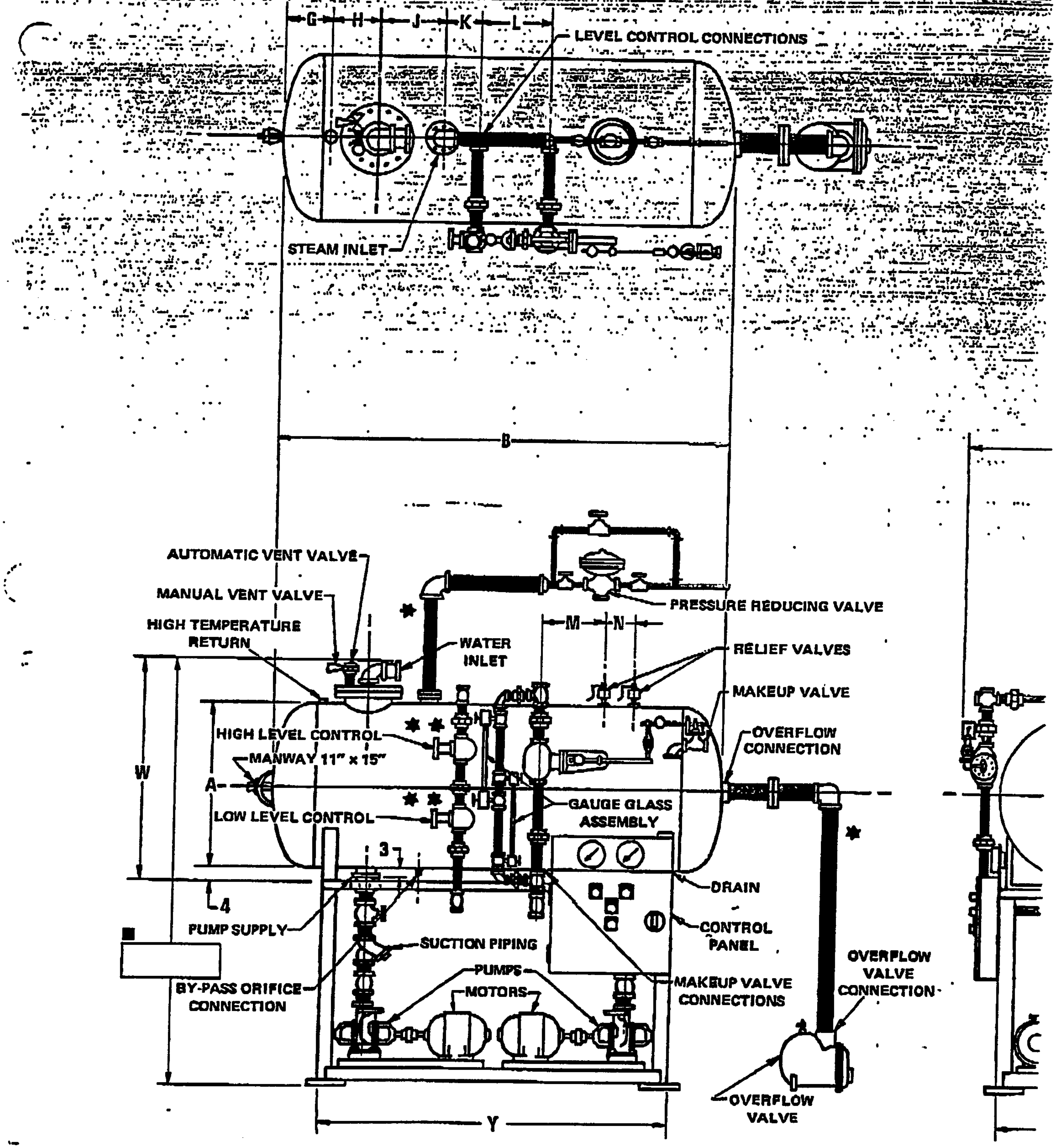
Milwaukee, WI 53201
(414) 359-0600

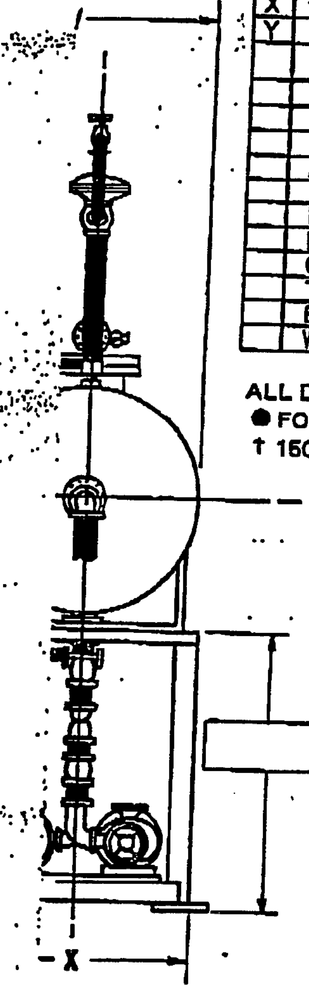


* Piping not furnished (control shipped loose).
** Not furnished unless specified.

Dimensions and Layout Data

	Spraymaster Model No.	SM15-P	SM30-P	SM45-P	SM70-P	SM100-P	SM140-P
	TANK DIMENSIONS AND RATINGS						
	Rating (lbs./hr.)	15,000	30,000	45,000	70,000	100,000	140,000
	Tank Capacity (gallons to overflow)	300	600	900	1,400	2,000	2,800
A	Tank Diameter	48	54	60	66	72	84
B	Tank Length	8'0"	10'0"	11'1"	14'10"	16'7"	15'4"
■	Total Height	varies with selection of tank and stand					
G		14¼	15¾	17½	18¼	19¼	21¼
H		18	18½	19	21½	22¼	22
J		20	30	20	20	20	24
K		12¼	12	13	14	17¾	13½
L		5¼	16	17¾	24½	36	25½
M		6	15	7	38	40	36
N		5	6	8	11	11	9
V	Total Width	5'6"	6'0"	6'6"	7'0"	7'6"	8'6"
▲		select correct stand height					
W		5'4"	6'4½"	6'9"	7'3"	7'11¼"	9'1"
X		60	60	72	74	79	94
Y		75½	94	102½	145½	163½	145½
	TANK CONNECTION SIZES						
	High Temperature Return	1½	2	2	3	3	3
	Level Control	1½	1½	1½	1½	1½	1½
	Steam Inlet	†6" Flg.	†6" Flg.	†6" Flg.	†6" Flg.	†6" Flg.	†8" Flg.
	Makeup Valve	2	2	2	2	2	2
	Relief Valve	2 @ 2"	2 @ 2"	3 @ 2"	3 @ 3"	3 @ 3"	3 @ 3"
	Pump Supply ●	3	3	†4" Flg.	†4" Flg.	†4" Flg.	†4" Flg.
	Drain	2	2	2	2	2	2
	Overflow	3	3	3	†4" Flg.	†4" Flg.	†4" Flg.
	Thermometer	¾	¾	¾	¾	¾	¾
	By-Pass Orifice ●	1	1	1	1	1	1
	Water Inlet	†1½" Flg.	†2" Flg.	†2" Flg.	†2½" Flg.	†3" Flg.	†4" Flg.

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED
● FOR EACH PUMP
† 150 LB. ASA FLANGE



GENERAL NOTES:

1. Customer to plug all fittings not used.
2. Mount tank above pump at elevation necessary for static head including safe allowance for piping friction as approved by pump manufacturer.
3. Tanks built to ASME Code includes 1/16" corrosion allowance.
4. Head and shell thickness based on 50 P.S.I. design pressure.
5. Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for construction by certified prints.

APPENDIX F

Process Heat Recovery and Insulation Repair Retrofit Calculations

APPENDIX F
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APPENDIX F

Process Heat Recovery and Insulation Repair Retrofit Calculations

Process Heat Recovery and Insulation Repair Retrofit Calculations

Several processes at WADF involve high temperature processing of explosive materials and munitions components. Heat recovery from these processes for space heating purposes is evaluated. These facilities include:

- Building 117-3 Small Items Decontamination Facility
  - Lead Items Rotary Furnace System (1 Each)
  - Detonating Items Rotary Furnace System (2 Each)
  - Small Items Furnace System (1 Each)
- Building 117-4 Bulk Explosives Disposal Facility
  - Bulk Explosives Slurry Incinerator System (2 Each)
- Building 117-15 Flashing Chamber
  - High temperature "burn-out" of small items contaminated by explosives

Processing buildings 117-5 and 117-6 utilize steam to assist in the removal of explosives from various munitions. Melt kettles installed in both buildings and a separation tank located in building 117-6 are semi-spherical steam-jacketed vessels. Insulation applied to the exterior of these vessels has fallen off. Insulation repairs are evaluated.

Energy saving calculations and economic analyses follow. Results are summarized on Table F-1.

Table F-1. Summary of Process Heat Recovery Retrofit Evaluations

Description	Econ Life Years	Energy $/Year	LCC$ Saved[1]	Investment $	SIR	Payback Years
Process Heat Recovery for Space Heating:						
Building 117-3 Furnaces	20	$4,436	$69,145	$68,872	1.00	19.60
Building 117-4 Incinerators	Not evaluated; concept is similar to 117-3 heat recovery					
Building 117-15 Flashing Chamber	Not technically feasible without major process modifications					
Melt Kettle and Separation Tank Insulation Repairs						
Buildings 117-5 & 117-6	15	$4,368	$53,687	$5,907	9.09	1.61

Note 1: LCC$ Saved are life cycle cost savings including both energy and non-energy cost savings.

Heat Recovery from Processing in Building 117-3

Each of the processes in the Small Items Decontamination Building involves exposing explosives contaminated components to high temperatures to combust any residual explosive materials and transfer to storage for metals recycling.

Heat recovery is possible from high temperature breaching between rotary furnaces and cyclone separators (the first step in the air pollution control equipment). Custom designed heat exchangers can be fabricated to remove some of the heat from the flue exteriors without intrusive modifications into process equipment. Such heat exchangers would consist of concentric flue pipe sections, flooded with heat transfer fluid. (Outer piping would be "dimple-plate" to promote turbulent flow.)

The heat recovery concept is to recover sufficient heat to displace the need for steam required for space heating purposes. Heating fluid (Dowtherm or a similar liquid) is pumped between the heat

exchanger placed on rotary furnace breaching and a heat exchanger to be placed upstream of the steam to ethylene-glycol heat exchanger in the mechanical room. The system is sized to recover 100% of the space heat needed and would displace the need for steam heating whenever the rotary furnaces are operating. Since it is unlikely that both rotary furnaces would operate simultaneously, three heat exchangers are needed, each with the capacity to recover 50% of the space heating load. The 3 heat exchangers must each be sized to recover 1,273,066 BTUH. (Refer to heating equipment list.)

Assuming a ΔT for the heat recovery fluid of 40°F, each heat exchanger must be capable of receiving flow of about 127 gpm. This flow rate requires a header of about 3-inch diameter. Individual heat transfer piping to be welded to the flue are assumed 1-inch diameter. Based on a U value of 1,000 BTU per °F-SF, approximately 32 SF of heat transfer area is required for each of the three flues.

Based on computer simulations of the building heating system, about 969,580 kBTU per year of fuel oil is required after implementation of building envelope and HVAC controls retrofits. Adjusting for boiler efficiency improvement from 55% to 71.4% (resulting from recommended steam system retrofits), the building HVAC system fuel oil requirement (as steam) is: 746,875 kBTU/Year.

The circulation pump is about 3HP; based on 16 hours per day operation for 3 months, power usage is estimated at 3,223 kWH per year.

The life cycle cost analysis for this concept results in an SIR of about 1.00 and a payback period of 19.6 years even though very generous assumptions are made for this first screening and analysis. This retrofit is not recommended due to the long payback and marginal SIR.

Heat Recovery from Processing in Building 117-4

Building 117-4, Bulk Disposal Building, houses processing equipment for incinerating a slurry of explosives in two incinerators. Sections of the incinerator (kiln) breaching could be fitted with heat exchangers similar to those proposed for building 117-3 in the above discussion. The type of installation, heat loads and expected energy recovery are expected to be proportional to those developed above, thus, heat recovery without contacting the flue gasses directly is ruled out as a viable option. Furthermore, it is unlikely that incinerator runs will be coincident with the need for space heating in the building. Thus, no further analysis of heat recovery from building 117-4 incinerators is conducted.

Heat Recovery from Processing in Building 117-15

Building 117-3, Flashing Chamber, contains a large chamber that is heated to high temperature for extended periods. The system has recently undergone an extensive modification of combustion controls and optimization by the Tennessee Valley Authority (TVA) for certification by the Environmental Protection Agency (EPA). EPA compliance testing for atmospheric emissions is currently underway (December 1994) and is expected to be successful. Presuming that the facility will be given permission to operate, the present 55-inch diameter exhaust stack is discharging about 2,000 SCFM at between 1,750°F and 1,850°F. Heat recovery is possible if it can be installed without imparting additional back-pressure to the exhaust fan systems.

The concept is to install a heat reclamation coil at the top of the exhaust stack. A static pressure regain section is required to overcome backpressure from the heat recovery coil.

Based on exhaust at:	1,800	°F and	2,000	SCFM, actual flue gas properties are:		
			8,692	ACFM, at	527	FPM (actual)

Based on a heat recovery coil with 0.10-inches H_2O of pressure drop; static regain section is sized: where VP is the velocity pressure in inches of H_2O; $VP_1 = (V_1/4{,}007)^2 =$ 0.0173 inches as H_2O

In order to regain even 0.1 inch as H_2O of velocity pressure, the original flue velocity would have to be at least as high as: 1,267 FPM.

Thus, there is not enough velocity pressure originally available to allow a regain flue section to overcome the pressure drop across a coil. In order to provide any heat recovery, then, the existing fan systems serving the Flashing Chamber will have to be retuned to overcome the coil pressure drop.

The operating system at the Flashing Chamber is extremely sensitive. Based on discussions with TVA personnel who have recently modified the process for proper operation and for compliance with the EPA's atmospheric discharge requirements, a great deal of effort would be required to rebalance the system again, possibly requiring several man-months of effort of highly compensated experts.

Modifications to recover heat from the Flashing Chamber operations is, thus, not recommended.

HVAC Heating Equipment - Building 117-3

Control Room, Office & Toilets

HC-601	1	EA	208,000	BTUH
RA-605	1	EA	8,259	BTUH
RA-606	1	EA	7,165	BTUH
Subtotal			223,424	

Work Corridor, Cells and Storage Areas

HC-602	1	EA	510,000	BTUH
DH-601	2	EA	530,000	BTUH
RA-601	1	EA	41,867	BTUH
RA-602	3	EA	35,820	BTUH
RA-603	1	EA	34,845	BTUH
RA-604	2	EA	21,867	BTUH
RA-607	1	EA	58,398	BTUH
RA-608	1	EA	58,398	BTUH
Subtotal			1,914,702	

Mechanical Room

HC-603	1	EA	730,000	BTUH
UH-601	2	EA	63,662	BTUH
Subtotal			857,324	

Total for Building 2,995,450 BTUH

Assume 85% Diversity for Heating Equipment Load
Design Load = 2,546,133 BTUH

HVAC Heating Equipment - Building 117-4

Control Room, Offices & Toilets

HC-401	1	EA	7,600	BTUH
RA-403	1	EA	Electric (N/A for this evaluation)	
RA-404	1	EA	7,500	BTUH
RA-405	1	EA	7,500	BTUH
Subtotal			15,000	

Work & Processing Areas

HC-402	1	EA	924,000	BTUH
DH-401	1	EA	530,000	BTUH
RA-401	2	EA	31,366	BTUH
RA-402	4	EA	12,781	BTUH
Subtotal			1,567,856	

Mechanical Room

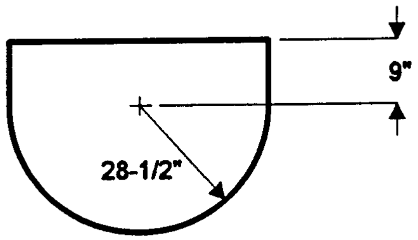
HC-403	1	EA	319,000	BTUH
UH-401	1	EA	33,290	BTUH
Subtotal			352,290	

Total for Building 1,935,146 BTUH

Assume 85% Diversity for Heating Equipment Load
Design Load = 1,644,874 BTUH

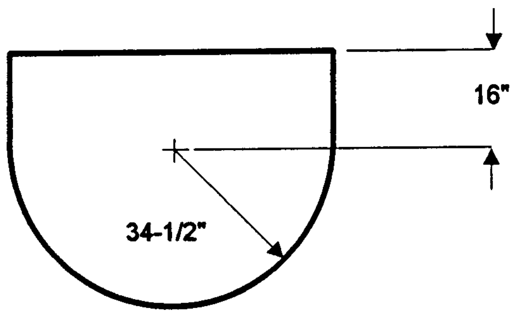
Buildings 117-5 & 117-6 Melt Kettle & Separation Tank Insulation Repairs

Insulation is falling off the melt kettles in buildings 117-5 and 117-6 and from the separation tank in Building 117-6. Existing insulation does not appear to be asbestos containing, and was installed in the mid-1970s, after regulations prohibiting its use were in force. These vessels are steam kettles with hemispherical bottom and cylindrical sides. Dimensions of each are shown on the diagrams below.



Melt Kettles, 2 Each in Buildings 117-5 & 117-6
Insulation on kettle tops is in adequate condition, insulation on the sides and bottoms is falling off.

Insulation repair area each =	46.6	SF
Total insulation repair area =	186.5	SF
Design steam load:	10	Lbs per Hour Each
Total steam load:	40	Lbs per Hour



Separation Tank, 1 in Building 117-6
Insulation on tank top is in adequate condition, insulation on the sides and bottoms is falling off.

Total insulation repair area =	76.0	SF
Design steam load:	20	Lbs per Hour

Each of these vessels is fitted with a steam jacket which receives 15 psig steam. The temperature of 15 psig steam is: 250 °F; ambient temperature in the work room (towers) where the vessels are located is about: 75 °F. The temperature difference is, thus: 175 °F

Heat losses to the air from bare and insulated surfaces at the above temperature difference:

	Bare		2" Insulation	
Horizontal surface, facing downwards:	2.252	BTUH per SF-°FΔT	0.24	BTUH per SF-°FΔT
Vertical surface:	2.580	BTUH per SF-°FΔT	0.24	BTUH per SF-°FΔT

Assume the cylindrical sides of the vessels loose heat at the "vertical surface" rate and that the hemispherical sections loose heat at the average of these two heat loss rates. Then, for bare, uninsulated, vessels, heat loss rates are:

	Bare		2" Insulation	
Melt Kettles:	20,038	BTUH from each Melt Kettle	1,959	BTUH from each Melt Kettle
	80,151	BTUH from 4 Melt Kettles	7,834	BTUH from 4 Melt Kettles
Separation Tank:	32,833	BTUH from the Separation Tank	3,193	BTUH from the Separation Tank
Total "Bare" Losses	112,983	BTUH Total "Insulated" Loss	11,027	BTUH

Repairing the insulation on these vessels, then, is estimated to save about 101,956 BTUH overall.

Assuming an operating schedule for the melt kettles and separation tank of 16 hours per day, 6 days per week, the annual steam load savings is estimated at: 509.0 Million BTU per year load savings.

Steam plant efficiency improvement and energy saving projects are evaluated in Appendices D and E. The steam plant efficiency after implementation of recommended projects is estimated at: 71.4%
No. 2 Fuel Oil savings based on this efficiency and the above load savings is: 713 Million BTU/Year.

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY97

Install Process Heat Recovery Run-Around Loop on Rotary Furnace Flues:
Building 117-3 Small Items Decontamination Facility

Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$61,493		
B. SIOH	$ 3,690		
C. Design Cost	$ 3,690		
D. Total Cost (1A+1B+1C)	$ 68,872		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$68,872

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	(11)	($141)	15.08	($2,126)
B. Dist	$6.13	747	$4,577	18.57	$84,997
C. LPG	-	-			
D. Other	-	-			
E. Elec Demand	$102.21	kW	$0	15.08	$0
F. Total		736	$4,436		$82,870

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($922)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($13,725)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.		0	1.000	$0
b.				
c.				
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4) ($13,725)

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$3,514	
5. Simple Payback (1G/4):	19.60	Years
6. Total Net Discounted Savings (2F5+3C):	$69,145	
7. Savings to Investment Ratio (SIR) 6/1G:	1.00	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY97

Repair Buildings 117-5 and 117-6 Melt Kettle and Separation Tank Insulation

Analysis Date: November 1994 Economic Life: 15 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$5,275		
B. SIOH	$ 316		
C. Design Cost	$ 316		
D. Total Cost (1A+1B+1C)	$ 5,907		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$5,907

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82			$0	12.02	$0
B. Dist	$6.13	712.8		$4,368	14.23	$62,164
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21		kW	$0	12.02	$0
F. Total		712.8		$4,368		$62,164

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	($5,275)	5	0.863	($4,552)
b.	($5,275)	10	0.744	($3,924)
c.				
d. Total	($10,549)			($8,476)

C Total Non Energy Discounted Savings (3A2+3Bd4) ($8,476)

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$3,665	
5. Simple Payback (1G/4):	1.61	Years
6. Total Net Discounted Savings (2F5+3C):	$53,687	
7. Savings to Investment Ratio (SIR) 6/1G:	9.09	

CONSTRUCTION COST ESTIMATE				Date Prepared November-94		Sheet 1	of 1
Project: ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect: Keller & Gannon							
Drawing No. Install Process Heat Recovery on Rotary Furnace Flues		Estimator: B. I. Horst			Checked By: R. C. Lennig		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-3 Process Heat Recovery from Rotary Furnaces for Space Heating (Simplified)							
Insulated Flue Section with Double Wall, Flooded as a Heat Exchanger	3	EA	$75.00	$225	$470.45	$1,411	$1,636
Pipe 3-inch Steel to Mech Room	504	LF	$30.91	$15,579	$7.06	$3,557	$19,135
Fiberglass Insulation, 2" Wall, 3" Pipe, All Service Jacket	504	LF	$5.73	$2,889	$2.76	$1,390	$4,279
Aluminum Jacket, 0.016"	924	SF	$5.10	$4,710	$0.56	$518	$5,228
Circulating Pump: 3 HP, to 150 GPM	1	EA	$152	$152	$1,181	$1,181	$1,333
Heat Exchanger	1	EA	$948.12	$948	$9,797	$9,797	$10,745
Wiring & Conduit	100	LF	$5.16	$516	$1.90	$190	$706
Motor Starter (Mechanical Room)	1	EA	$145	$145	$171	$171	$316
Subtotal				$25,163		$18,215	$43,378
Nevada Sales Tax	3.75%	%		-		$683	$683
Subtotal							$44,061
Contractor OH & Profit	25.0%	%					$11,015
Subtotal							$55,077
Bond	1.5%	%					$826
Subtotal							$55,903
Estimating Contingency	10.0%	%					$5,590
Total Probable Construction Cost							**$61,493**

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year:

$922 per year.

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CONSTRUCTION COST ESTIMATE	Date Prepared November-94	Sheet 1	of 1
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate	
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada		Code A (no design competed)	
Engineer-Architect: Keller & Gannon			
Drawing No. **Repair Melt Kettle & Separation Tank Insulation**	Estimator: B. I. Horst	Checked By: R. C. Lennig	

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
Buildings 117-5 & 117-6 Melt Kettle and Separation Tank Insulation Repairs							
Remove Existing Deteriorated Blanket Insulation from Vessels	263	SF	$4.11	$1,078	$0.00	$0	$1,078
Fix Metal Insulation Tabs to Vessels, One per SF to Retain Insulation	263	EA	$3.25	$852	$1.00	$263	$1,115
Blanket Type Fiberglass Insulation, 2-Inch Thick, 1-1/2 LB/SF Density	315	SF	$4.05	$1,276	$0.92	$290	$1,566
Subtotal				$3,206		$552	$3,759
Nevada Sales Tax	3.75%	%		-		$21	$21
Subtotal							$3,779
Contractor OH & Profit	25.0%	%					$945
Subtotal							$4,724
Bond	1.5%	%					$71
Subtotal							$4,795
Estimating Contingency	10.0%	%					$480
Total Probable Construction Cost							**$5,275**

Melt Kettle and Separation Tank insulation is subject to exposure to steam throughout its useful life. The existing installation has been operating only a couple of years and has deteriorated rapidly. Assume that insulation must be replaced every 5 years. **$5,275** each 5 years.

APPENDIX G

Lighting Data and Energy Calculations

APPENDIX G
Table of Contents

LIGHTING ENERGY CALCULATION METHODOLOGY

Lighting Energy Use

Lighting energy use for buildings investigated in conjunction with this study is determined based on a combination of field observations, design data and on experience in similar projects.

Electric power usage for present and proposed fixture retrofits is determined similarly. Fixture electric loads (kW) are determined and then multiplied by the operating hours per year.

Operating hours per year are determined based on the building schedule and on the function of the room in which the fixture is located. Room and building schedules are determined by interviewing occupants. A demand/diversity factor is applied to scheduled room usage.

Lighting energy use calculations are explained in detail below; tabular summaries of calculations to determine present lighting energy use appear on Table G-1. Notations are explained on a legend as Table G-2. Room/building schedules and demand factors are provided on Table G-3 and existing lighting fixture electric demands are summarized on Table G-4.

Lighting Energy Calculations

Label	Contents / Calculation Explanation
TASK_CODE	Room function: See legend on Table G-2. (Field Data)
TYPE_CODE	Fixture Type: Refer to legend on Tables G-2. (Field Data)
LAMP_TYPE	Lamp types: Incandescent, Fluorescent, MV Mercury Vapor (Catalog Data) Refer to Table G-2 for existing lamp/fixture types.
LAMPS/FXTR	Lamps per fixture (Field Data)
WATTS/FXTR	Watts per fixture (Refer to Table G-4) (Catalog Data)
NO_FXTR	Number of fixtures in room/area (Field Data)
KW	WATTS/FXTR * NO_FXTR/1000 = Room Connected Lighting load (kW)
HR/WK	Operating hours per week (Refer to Table G-3) (Field Data)
DEMAND	Demand factor (Refer to Table G-3)
KWH/Y	KW * HR/WK * 52 * DEMAND = Annual Room Lighting Power Use (kWH/year)

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-1	Services & Support	1	4	R	F40T12	40	4	172	4	85	8'-0"	L	L	L	NA	1 Zone Switch	0.7	96	0.69	2,404
117-1	Services & Support	4	18	R	F40T12	40	2	86	12	77	9'-0"	L	L	L	NA	1 Zone Switch	1.0	96	1.03	5,152
117-1	Services & Support	5	18	R	F40T12	40	4	172	16	60	9'-0"	L	M	L	NA	1 Zone Switch	1.0	96	2.75	13,738
117-1	Services & Support	6	18	R	F40T12	40	2	86	4	43	9'-0"	L	L	L	NA	1 Zone Switch	1.0	96	0.34	1,717
117-1	Services & Support	7	18	R	F40T12	40	2	86	12	77	9'-0"	L	L	L	NA	2 Zone Switches	1.0	96	1.03	5,152
117-1	Services & Support	9	17	R	F40T12	40	2	86	22	20	11'-6"	L	M	L	NA	3 Zone Switches	1.0	96	1.89	9,445
117-1	Services & Support	10	8	R	F40T12	40	2	86	3	85	12'-0"	L	M	M	NA	-	0.6	96	0.26	773
117-1	Services & Support	11	8	R	F40T12	40	2	86	3	-	-	L	L	L	NA	1 Switch Zone	0.6	96	0.26	773
117-1	Services & Support	12	8	R	F40T12	40	2	86	14	45	12'-0"	L	M	D	NA	-	0.6	96	1.20	3,606
117-1	Services & Support	13	8	R	F40T12	40	2	86	3	-	-	L	L	L	NA	1 Switch Zone	0.6	96	0.26	773
117-1	Services & Support	14	8	R	F40T12	40	2	86	12	40	12'-0"	L	M	D	NA	1 Zone Switch	0.6	96	1.03	3,091
117-1	Services & Support	15	8	R	F40T12	40	2	86	3	-	-	L	L	L	NA	1 Switch Zone	0.6	96	0.26	773
117-1	Services & Support	16	1	R	F40T12	40	2	86	1	45	8'-0"	L	L	L	NA	1 Zone Switch	0.8	96	0.09	343
117-1	Services & Support	17	8	R	F40T12	40	2	86	1	50	8'-0"	L	L	L	NA	2 Zone Switches	0.6	96	0.09	258
117-1	Services & Support	18	4	R	F40T12	40	4	172	2	75	8'-0"	L	L	L	NA	1 Zone Switch	0.7	96	0.34	1,202
117-1	Services & Support	19	4	R	F40T12	40	4	172	2	65	8'-0"	L	L	L	NA	1 Zone Switch	0.7	96	0.34	1,202
117-1	Services & Support	20	4	R	F40T12	40	4	172	15	97	9'-0"	L	L	L	NA	2 Zone Switches	0.7	96	2.58	9,016
117-1	Services & Support	21	1	R	F40T12	40	4	172	2	50	8'-0"	L	L	L	NA	2 x 3-Way Switches	0.8	96	0.34	1,374
117-1	Services & Support	21	1	R	F40T12	40	2	86	3	52	8'-0"	L	L	L	NA	-	0.8	96	0.26	1,030
117-1	Services & Support	22	4	R	F40T12	40	4	172	2	52	8'-0"	L	L	L	NA	-	0.7	96	0.34	1,202
117-1	Services & Support	23	1	R	F40T12	40	4	172	5	50	10'-0"	L	L	L	NA	2 x 3-Way Switches	0.8	96	0.86	3,434
117-1	Services & Support	24	1	R	F40T12	40	2	86	1	52	8'-0"	L	L	L	NA	-	0.8	96	0.09	343
117-1	Services & Support	24	1	R	F40T12	40	1	50	1	50	10'-0"	L	L	L	NA	-	0.8	96	0.05	200
117-1	Services & Support	25	1	R	F40T12	40	2	86	1	-	-	L	L	M	NA	1 Zone Switch	0.8	96	0.09	343

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-1	Services & Support	26	1	R	F40T12	40	2	86	1	-	-	L	L	M	NA	-	0.8	96	0.09	343
117-1	Services & Support	27	16	R	F40T12	40	2	86	1	-	-	L	M	M	NA	1 Zone Switch	1.0	12	0.09	54
117-1	Services & Support	28	1	R	F40T12	40	2	86	1	20	11'-6"	L	M	M	NA	1 Zone Switch	0.8	96	0.09	343
117-1	Services & Support	28	12	R	F40T12	40	2	86	1	20	11'-6"	L	D	L	NA	1 Zone Switch	0.7	96	0.09	301
117-1	Services & Support	31	16	P-Ind	F40T12	40	2	86	1	-	-	M	L	D	NA	1 Zone Switch	1.0	12	0.09	54
117-1	Services & Support	32	12	R	F40T12	40	2	86	1	-	-	L	L	L	NA	1 Zone Switch	0.7	96	0.09	301
117-1	Services & Support	33	12	S	F40T12	40	2	86	4	-	-	-	-	-	-	1 Switch Zone	0.7	96	0.34	1,202
117-1	Services & Support	34	12	S	F40T12	40	2	86	2	-	-	-	-	-	-	1 Switch Zone	0.7	96	0.17	601
117-1	Services & Support	35	12	S	F40T12	40	2	86	2	-	-	L	L	L	NA	1 Switch Zone	0.7	96	0.17	601
117-1	Services & Support	36	12	S	F40T12	40	2	86	4	-	-	L	L	L	NA	1 Switch Zone	0.7	96	0.34	1,202
117-1	Services & Support	2&3	18	S	F40T12	40	2	86	2	12	To Roof	L	M	L	NA	1 Zone Switch	1.0	96	0.17	859
117-1	Services & Support	Exit Signs	Exit	S	F	6	2	20	9	NA	NA	NA	NA	NA	NA	-	1.0	168	0.18	1,572
117-1	Services & Support	Exterior	Extr	S	F40T12	40	2	86	2	-	-	L	L	L	NA	Photcell Control	1.0	84	0.17	751
117-1	Services & Support	Exterior	Extr	S	MV	175	1	198	4	NA	NA	NA	NA	NA	NA	Photcell Control	1.0	84	0.79	3,459
117-1	Services & Support	30, Mech	15	P-Ind	F40T12	40	2	86	9	-	-	L	L	D	NA	1 Zone Switch	1.0	4	0.77	161

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (KWH/Yr)
117-2	Boiler Building	Grnd Flr	14	P-Ind	F40T12	40	1	50	19	-	-	L	L	D	NA	-	0.6	24	0.95	711
117-2	Boiler Building	Basement-Wtr Trtmnt	14	P-Ind	F40T12	40	2	86	23	25	9'-0"	M	M	M	NA	2 x 3-Way Switches	0.6	24	1.98	1,481
117-2	Boiler Building	Basement-Open Area	14	P-Ind	F40T12	40	2	86	19	20	9'-0"	M	M	M	NA	-	0.6	24	1.63	1,224
117-2	Boiler Building	Exterior	Extr	S	MV	175	1	198	20	NA	NA	NA	NA	NA	NA	Photocell Control	1.0	84	3.96	17,297
117-2	Boiler Building	Note: Above information for the boiler plant includes only the areas presently in active use. Remaining areas not used, thus, lighting retrofits are not applicable.																		

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-3	Decontam & Small Parts	Supervisor Office	4	R	F40T12	40	4	172	9	55	8'-0"	L	D	M	NA	2 Zone Switches	0.7	96	1.55	5,409
117-3	Decontam & Small Parts	Corridor	1	S	F40T12	40	4	172	2	20	8'-0"	L	D	M	NA	1 Zone Switch	1.0	96	0.34	1,717
117-3	Decontam & Small Parts	Men's W/C	8	S	F40T12	40	4	172	2	25	8'-0"	L	M	M	NA	1 Zone Switch	0.6	96	0.34	1,030
117-3	Decontam & Small Parts	Janitor's Closet	16	S	I	100	1	100	1	25	8'-0"	L	M	M	NA	1 Zone Switch	1.0	8	0.10	42
117-3	Decontam & Small Parts	Women's W/C	8	S	F40T12	40	4	172	2	30	8'-0"	L	M	M	NA	1 Zone Switch	0.6	96	0.34	1,030
117-3	Decontam & Small Parts	Women's Lounge	8	S	F40T12	40	4	172	1	114	8'-0"	L	M	M	NA	1 Zone Switch	0.6	96	0.17	515
117-3	Decontam & Small Parts	Control Room	4	R	F40T12	40	4	172	17	120	9'-3"	L	M	M	NA	2 Zone Switches	0.7	96	2.92	10,218
117-3	Decontam & Small Parts	Mechanical Room	15	P-Ind	F40T12	40	2	86	56	20	8'-6"	L	M	D	NA	-	1.0	24	4.82	6,010
117-3	Decontam & Small Parts	Loading Dock	14	P-ExP	F48T12VH	110	2	250	12	-	10' to 12'	L	M	D	NA	-	0.8	96	3.00	11,981
117-3	Decontam & Small Parts	Work Corridor	14	P-ExP	F48T12VH	110	2	250	44	22	11'-0"	L	L	D	NA	-	0.8	96	11.00	43,930
117-3	Decontam & Small Parts	Inert Storage	14	P	F40T12	40	2	86	32	25	11'-0"	L	L	D	NA	-	0.8	96	2.75	10,990
117-3	Decontam & Small Parts	Breakdown Area	14	P-ExP	F48T12VH	110	2	250	6	-	At Ceiling	L	L	D	NA	1 Zone Switch	0.8	96	1.50	5,990
117-3	Decontam & Small Parts	10, Cell 6	14	P-ExP	F48T12VH	110	2	250	2	-	At Ceiling	L	L	D	NA	1 Zone Switch	0.8	96	0.50	1,997
117-3	Decontam & Small Parts	9, Cell 5	14	P-ExP	F48T12VH	110	2	250	2	-	At Ceiling	L	L	D	NA	1 Zone Switch	0.8	96	0.50	1,997
117-3	Decontam & Small Parts	8, Cell 4	14	P-ExP	F48T12VH	110	2	250	6	-	At Ceiling	L	L	D	NA	1 Zone Switch	0.8	96	1.50	5,990
117-3	Decontam & Small Parts	7, Cell 3	14	P-ExP	F48T12VH	110	2	250	6	20	At Ceiling	L	L	D	NA	1 Zone Switch	0.8	96	1.50	5,990
117-3	Decontam & Small Parts	6, Cell 2	14	P-ExP	F48T12VH	110	2	250	6	20	At Ceiling	L	L	D	NA	1 Zone Switch	0.8	96	1.50	5,990
117-3	Decontam & Small Parts	5, Cell 1	14	P-ExP	F48T12VH	110	2	250	6	20	At Ceiling	L	L	D	NA	1 Zone Switch	0.8	96	1.50	5,990
117-3	Decontam & Small Parts	Exit Signs	Exit	S	F	6	2	20	12	NA	NA	NA	NA	NA	NA	-	1.0	168	0.24	2,097
117-3	Decontam & Small Parts	Exterior	Extr	S	MV	175	1	198	43	NA	NA	NA	NA	NA	NA	Photocell & Switches	1.0	84	8.51	37,189

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-4	Bulk Explosives Disposal	AG Work Corridor	14	P-ExP	F48T12VH	110	2	250	14	18	11'-0"	L	M	D	NA	2 Zone Switches	1.0	96	3.50	17,472
117-4	Bulk Explosives Disposal	AG Cell 1	14	P-ExP	MH	400	1	460	8	20	10'-0"	M	M	M	NA	2 Zone Switches	1.0	96	3.68	18,371
117-4	Bulk Explosives Disposal	AG Cell 1	14	S-ExP	F48T12VH	110	2	250	2	12	-	M	M	M	NA	1 Switch	1.0	96	0.50	2,496
117-4	Bulk Explosives Disposal	AG Cell 2	14	P-ExP	MH	400	1	460	8	14	10'-0"	M	M	M	NA	2 Zone Switches	1.0	96	3.68	18,371
117-4	Bulk Explosives Disposal	AG Cell 2	14	S-ExP	F48T12VH	110	2	250	5	10	11'-0"	M	M	M	NA	1 Switch	1.0	96	1.25	6,240
117-4	Bulk Explosives Disposal	AG Roof	14	P-ExP	I	100	1	100	4	NA	NA	NA	NA	NA	NA	1 Switch	1.0	96	0.40	1,997
117-4	Bulk Explosives Disposal	AG Exit	Exit	S	F	6	2	20	2	NA	NA	NA	NA	NA	NA	-	1.0	168	0.04	349
117-4	Bulk Explosives Disposal	Exterior	Extr	S	MV	175	1	198	3	NA	NA	NA	NA	NA	NA	Photocell Control	1.0	84	0.59	2,595
117-4	Bulk Explosives Disposal	UG Control Room	4	R	F40T12	40	4	172	17	90/40	9'-0"	L	M	L	NA	Bi-level Switching	0.9	96	2.92	13,137
117-4	Bulk Explosives Disposal	UG Mech Room	15	P-Ind	F40T12	40	2	86	34	50	9'-0"	L	L	M	NA	1 Switch Zone	1.0	24	2.92	3,649
117-4	Bulk Explosives Disposal	UG Toilet - Women	8	S	F40T12	40	4	172	2	35	8'-0"	L	M	M	NA	1 Switch Zone	0.6	96	0.34	1,030
117-4	Bulk Explosives Disposal	Women's Lounge	8	S	F40T12	40	4	172	1	131	8'-0"	L	M	M	NA	1 Switch Zone	0.6	96	0.17	515
117-4	Bulk Explosives Disposal	UG Corridor	1	S	F40T12	40	4	172	2	25	8'-0"	L	M	M	NA	1 Switch Zone	0.8	96	0.34	1,374
117-4	Bulk Explosives Disposal	UG Toilet - Men	8	S	F40T12	40	4	172	2	38	9'-0"	L	M	M	NA	1 Switch Zone	0.6	96	0.34	1,030
117-4	Bulk Explosives Disposal	UG Janitor Closet	16	S	I	100	1	100	1	-	-	L	M	M	NA	1 Switch Zone	1.0	8	0.10	42
117-4	Bulk Explosives Disposal	UG Exit Signs	Exit	S	F	6	2	20	7	-	-	NA	NA	NA	NA	-	1.0	168	0.14	1,223
117-4	Bulk Explosives Disposal	Exterior	Extr	S	MV	175	1	198	2	NA	NA	NA	NA	NA	NA	Photocell Control	1.0	84	0.40	1,730
117-4	Bulk Explosives Disposal	UG Super's Office	4	S	F40T12	40	1	50	6	90/45	9'-0"	L	L	L	NA	Bi-level Switching	0.9	96	0.30	1,348

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-5	Refining Building	Exterior	Extr	S	MV	175	1	198	16	NA	NA	NA	NA	NA	NA	Photocell Control	1.0	84	3.17	13,838
117-5	Refining Building	Toilet - Mens'	8	S	F40T12	40	2	86	3	32	8'-0"	L	M	D	NA	1 Switch Zone	0.6	96	0.26	773
117-5	Refining Building	Corridor	1	S	F40T12	40	2	86	1	25	8'-0"	L	L	M	NA	1 Switch Zone	0.7	96	0.09	301
117-5	Refining Building	Toilet - Womens'	8	S	F40T12	40	2	86	2	40	8'-0"	L	M	D	NA	1 Switch Zone	0.6	96	0.17	515
117-5	Refining Building	Lounge - Women's	8	S	F40T12	40	2	86	1	40	8'-0"	L	M	D	NA	1 Switch Zone	0.6	96	0.09	258
117-5	Refining Building	Janitor's Closet	16	S	I	100	1	100	1	-	8'-0"	L	M	D	NA	1 Switch Zone	1.0	12	0.10	62
117-5	Refining Building	Mechanical Room	15	P-Ind	F40T12	40	2	86	40	14	8'-0"	L	L	D	NA	2 x 3-Way Zones	0.8	96	3.44	13,738
117-5	Refining Building	Grnd Level Processing	14	P-ExP	F48T12VH	110	2	250	15	30	12'-0"	D	M	D	NA	Separate Switches	1.0	96	3.75	18,720
117-5	Refining Building	2nd Level Processing	14	P-ExP	F48T12VH	110	2	250	12	10 to 50	7'-6"	D	M	Grate	NA	Separate Switches	1.0	96	3.00	14,976
117-5	Refining Building	Top Level Processing	14	P-ExP	F48T12VH	110	2	250	16	-	At Roof	L	M	D	NA	Separate Switches	1.0	96	4.00	19,968
117-5	Refining Building	Top Level Processing	14	P-ExP	MH	400	1	460	8	-	At Roof	L	M	D	NA	Separate Switches	1.0	96	3.68	18,371
117-5	Refining Building	Exit Signs	Exit	S	F	6	2	20	11	NA	NA	NA	NA	NA	NA	-	1.0	168	0.22	1,922
117-5	Refining Building	Loading Docks	Extr	P-ExP	F48T12VH	110	2	250	14	NA	NA	NA	NA	NA	NA	2 Switch Zones	1.0	84	3.50	15,288

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-6	Steamout Building	South Tower	14	P-ExP	F48T12VH	110	2	250	18	16	See Plans	L	L	M	NA	LV Switches 4 Ea.	1.0	96	4.50	22,464
117-6	Steamout Building	South Tower	14	P-ExP	MH	400	1	460	12	16	See Plans	L	L	M	NA	LV Switches 4 Ea.	1.0	96	5.52	27,556
117-6	Steamout Building	Mechanics Brk. Room	17	P	F40T12	40	2	86	36	25	10'-0"	L	L	M	NA	4 Zone Switches	0.8	96	3.10	12,384
117-6	Steamout Building	Corridor	1	S	F40T12	40	4	172	4	16	8'-0"	L	L	L	NA	2 3-way Switches	0.6	96	0.69	2,061
117-6	Steamout Building	Toilet - Mens'	8	S	F40T12	40	4	172	2	100	8'-0"	L	L	M	NA	1 Switch	0.6	96	0.34	1,030
117-6	Steamout Building	Toilet - Womens'	8	S	F40T12	40	4	172	2	100	8'-0"	L	L	M	NA	1 Switch	0.6	96	0.34	1,030
117-6	Steamout Building	Womens' Lounge	8	S	F40T12	40	4	172	1	110	8'-0"	L	L	M	NA	1 Switch	0.6	96	0.17	515
117-6	Steamout Building	Janitor's Closet	16	S	I	150	1	150	1	-	8'-0"	L	L	M	NA	1 Switch	1.0	12	0.15	94
117-6	Steamout Building	Lab	18	R	F40T12	40	4	172	7	75	9'-0"	L	M	M	NA	2 Switches	0.7	96	1.20	4,207
117-6	Steamout Building	Mechanical Room North	15	P-Ind	F40T12	40	2	86	42	20	10'-0"	L	L	D	NA	2 Zone Switches	0.8	96	3.61	14,425
117-6	Steamout Building	Exit Signs	Exit	S	F	6	2	20	18	NA	NA	NA	NA	NA	NA	-	1.0	168	0.36	3,145
117-6	Steamout Building	Exterior	Extr	S	MV	175	1	198	15	NA	NA	NA	NA	NA	NA	Photocell Control	1.0	84	2.97	12,973
117-6A	Pump Building	Pumps	14	P-Ind	F40T12	40	2	86	10	18	15'-0"	L	L	M	NA	Panel Ckt Brkr	0.6	96	0.86	2,576
117-6A	Pump Building	Exterior	Extr	S	MV	175	1	198	3	NA	NA	NA	NA	NA	NA	-	1.0	84	0.59	2,595
117-7	Water Treatment	Filter Room	14	P-ExP	MH	400	1	460	9	19	-	L	M	D	NA	-	0.6	168	4.14	21,700
117-7	Water Treatment	Control Rm	4	S	F40T12	40	4	172	5	82	10'-0"	L	M	D	NA	1 Switch	1.0	168	0.86	7,513
117-7	Water Treatment	Chem Tanks	14	P-ExP	MH	400	1	460	3	40	-	L	M	D	NA	1 Switch	0.6	168	1.38	7,233
117-7	Water Treatment	Basement Pump Room	14	P-Ind	F40T12	40	2	86	10	-	-	-	-	-	NA	-	0.6	168	0.86	4,508
117-7	Water Treatment	Exterior	Extr	S	MV	175	1	198	5	NA	NA	NA	NA	NA	NA	2 Switches @ 4 + Photocell for 1	1.0	84	0.99	4,324

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-8	Mech. Removal Building	Supervisor's Office	4	R	F40T12	40	4	172	2	80	8'-0"	L	L	M	NA	1 Switch	0.8	96	0.34	1,374
117-8	Mech. Removal Building	Corridor	1	S	F40T12	40	4	172	2	25	8'-0"	L	L	M	NA	2 3-way Switches	0.6	96	0.34	1,030
117-8	Mech. Removal Building	Men's W/C	8	S	F40T12	40	4	172	2	82	8'-0"	L	L	M	NA	1 Switch	0.6	96	0.34	1,030
117-8	Mech. Removal Building	Jan Closet	16	S	I	150	1	150	1	82	8'-0"	L	L	M	NA	1 Switch	1.0	12	0.15	94
117-8	Mech. Removal Building	Women's W/C	8	S	F40T12	40	4	172	2	80	8'-0"	L	M	M	NA	1 Switch	0.6	96	0.34	1,030
117-8	Mech. Removal Building	Women's Lounge	8	S	F40T12	40	4	172	1	120	8'-0"	L	M	M	NA	1 Switch	0.6	96	0.17	515
117-8	Mech. Removal Building	Working Corridor	14	P-ExP	F48T12VH	110	2	250	24	31	11'-0"	L	M	D	NA	2 Zone Switches	1.0	96	6.00	29,952
117-8	Mech. Removal Building	Mechanical Room	15	P-Ind	F40T12	40	2	86	25	65	12'-0"	L	L	D	NA	1 Switch	0.8	96	2.15	8,586
117-8	Mech. Removal Building	4, Cell 1	14	S-ExP	F48T12VH	110	2	250	4	18	12'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-8	Mech. Removal Building	5, Cell 2	14	S-ExP	F48T12VH	110	2	250	4	18	12'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-8	Mech. Removal Building	6, Cell 3	14	S-ExP	F48T12VH	110	2	250	4	18	12'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-8	Mech. Removal Building	2, Boxing Area 1	14	S-ExP	F48T12VH	110	2	250	2	18	12'-0"	L	L	D	NA	1 Switch	1.0	96	0.50	2,496
117-8	Mech. Removal Building	3, Boxing Area 2	14	S-ExP	F48T12VH	110	2	250	2	18	12'-0"	L	L	D	NA	1 Switch	1.0	96	0.50	2,496
117-8	Mech. Removal Building	10, Control Room	4	R	F40T12	40	4	172	10	120/75	10'-0"	L	M	M	NA	Bilevel Switch	0.8	96	1.72	6,869
117-8	Mech. Removal Building	Exit Signs	Exit	S	F	6	2	20	6	NA	NA	NA	NA	NA	NA	-	1.0	168	0.12	1,048
117-8	Mech. Removal Building	Exterior	Extr	S	MV	175	1	198	9	NA	NA	NA	NA	NA	NA	Photocell Control	1.0	84	1.78	7,784

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-10	Preparation Building	Distribution Area	14	P-EXP	F48T12VH	110	2	250	24	-	11'-0"	L	L	D	NA	-	1.0	96	6.00	29,952
117-10	Preparation Building	Working Corridor	14	P-EXP	F48T12VH	110	2	250	26	-	11'-0"	L	L	D	NA	-	1.0	96	6.50	32,448
117-10	Preparation Building	Off-Loading Area	14	P-EXP	F48T12VH	110	2	250	24	-	11'-0"	L	L	D	NA	-	1.0	96	6.00	29,952
117-10	Preparation Building	Cell 1	14	P-EXP	F48T12VH	110	2	250	4	16	11'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-10	Preparation Building	Cell 2	14	P-EXP	F48T12VH	110	2	250	4	15	11'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-10	Preparation Building	Cell 3	14	P-EXP	F48T12VH	110	2	250	4	20	11'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-10	Preparation Building	Cell 4	14	P-EXP	F48T12VH	110	2	250	4	20	11'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-10	Preparation Building	Cell 5	14	P-EXP	F48T12VH	110	2	250	4	22	11'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-10	Preparation Building	Cell 6	14	P-EXP	F48T12VH	110	2	250	4	15	11'-0"	L	L	D	NA	1 Switch	1.0	96	1.00	4,992
117-10	Preparation Building	Corridor	1	R	F40T12	40	4	172	2	26	8'-0"	L	M	L	NA	2 3-way Switches	0.7	96	0.34	1,202
117-10	Preparation Building	Control Rm	4	R	F40T12	40	4	172	15	75	10'-0"	L	M	L	NA	2 3-way Switches	0.8	96	2.58	10,303
117-10	Preparation Building	Women's W/C	8	R	F40T12	40	4	172	2	115	8'-0"	L	M	M	NA	1 Switch	0.6	96	0.34	1,030
117-10	Preparation Building	Women's Lounge	8	R	F40T12	40	4	172	1	120	8'-0"	L	M	M	NA	1 Switch	0.6	96	0.17	515
117-10	Preparation Building	Men's W/C	8	R	F40T12	40	4	172	2	100	8'-0"	L	M	M	NA	1 Switch	0.6	96	0.34	1,030
117-10	Preparation Building	Janitor's Closet	16	S	I	150	1	150	1	100	8'-0"	L	M	M	NA	1 Switch	1.0	12	0.15	94
117-10	Preparation Building	Supervisor's Office	4	R	F40T12	40	4	172	8	70	10'-0"	L	M	L	NA	2 3-way Switches	0.8	96	1.38	5,495
117-10	Preparation Building	Mechanical Room	15	P-Ind	F40T12	40	2	86	55	45-50	9'-0"	L	L	D	NA	2 Zone Switches	0.8	96	4.73	18,890
117-10	Preparation Building	Exit Signs	Exit	S	F	6	2	20	16	NA	NA	NA	NA	NA	NA	-	1.0	168	0.32	2,796
117-10	Preparation Building	Exterior	Extr	S	MV	175	1	198	15	NA	NA	NA	NA	NA	NA	Photocell Control	1.0	84	2.97	12,973

Table G-1 Baseline Lighting Systems and Energy Use

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Measured Light (FC)	Ceiling Height (ft)	Ceiling Color	Wall Color	Floor Color	Window Code	Remarks	Demand Factor	Fixture (Hr/Wk)	Present Demand (kW)	Present Use (kWH/Yr)
117-11	Accumulator Building	N Pump Room	14	S-ExP	F48T12VH	110	2	250	2	32	At Roof	L	M	D	NA	1 Switch Zone	0.4	96	0.50	998
117-11	Accumulator Building	N Accumu-lator Room	14	S-ExP	F48T12VH	110	2	250	5	28	At Roof	L	M	D	NA	1 Switch Zone	0.4	96	1.25	2,496
117-11	Accumulator Building	Boxing Room	14	S-ExP	F48T12VH	110	2	250	8	25	At Roof	L	M	D	NA	1 Switch Zone	0.4	96	2.00	3,994
117-11	Accumulator Building	S Accumu-lator Room	14	S-ExP	F48T12VH	110	2	250	5	30	At Roof	L	M	D	NA	1 Switch Zone	0.4	96	1.25	2,496
117-11	Accumulator Building	S Pump Room	14	S-ExP	F48T12VH	110	2	250	2	34	At Roof	L	M	D	NA	1 Switch Zone	0.4	96	0.50	998
117-11	Accumulator Building	Exterior	Extr	S	MV	175	1	198	3	NA	NA	NA	NA	NA	NA	Photocell Control	1.0	84	0.59	2,595
117-15	Flashing Chamber	A	14	P-ExP	F48T12VH	110	2	250	10	12	12'-0"	D	M	D	NA	2 Switches	0.8	96	2.50	9,984
117-15	Flashing Chamber	B	14	P-ExP	F48T12VH	110	2	250	6	6	12'-0"	D	M	D	NA	2 Switches	0.8	96	1.50	5,990

Table G-2. Lighting Systems Legend

Task Code	Description
1	Corridors
2	Kitchens
3	Dining
4	Offices - General & Classrooms
5	Conference
6	Offices - Drafting
7	Laundry
8	Toilets / Locker Rooms
9	Sleeping Quarters
10	Supply Rooms
11	Repair Shops
12	Storage Rooms
13	Retail Stores
14	Industrial Process
15	Mechanical / Electrical Room
16	Janitor's Closet
17	Lounge / Break Room
18	Chemical Analysis Laboratory
Extr	Exterior Lighting
Exit	Exit Light

Fixture Type Code	Description
P	Pendant-Mounted Fixture
P-ExP	Pendant-Mounted Explosion Proof Fixture
P-Ind	Pendant-Mounted Industrial Fixture
R	Recessed Fixture
S	Surface-Mounted Fixture
S-ExP	Surface-Mounted Explosion Proof Fixture

Ceiling, Wall and Floor Colors

L	Light
M	Medium
D	Dark

Window Code

NA	Not Applicable

Lamp Type	Description
F32T8	Fluorescent Lamp, 48-inches long, 32 Watts, 1-inch diameter
F40T12	Fluorescent Lamp, 48-inches long, 40 Watts, 1-1/2-inch diameter
F40T12VH	Very High Output Fluorescent Lamp, 48-inches long, 110 Watts, 1-1/2-inch diameter
F, 6 Watt	Fluorescent Lamp for Exit Fixtures, 6 Watts
I	Incandescent Lamp
MV	Mercury Vapor Lamp
MH	Metal Halide Lamp

Table G-3. Lighting Energy Use Factors

Task Code	Description	Demand Factors per Building											
		117-1	117-2	117-3	117-4	117-5	117-6	117-6A	117-7	117-8	117-10	117-11	117-15
1	Corridors	0.8	NA	1.0	0.8	0.7	0.6	NA	NA	0.6	0.7	NA	NA
2	Kitchens	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Dining	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	Offices - General & Classrooms	0.7	NA	0.7	0.9	NA	NA	NA	1.0	0.8	0.8	NA	NA
5	Conference	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	Offices - Drafting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Laundry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Toilets / Locker Rooms	0.6	NA	0.6	0.6	0.6	0.6	NA	NA	0.6	0.6	NA	NA
9	Sleeping Quarters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	Supply Rooms	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	Repair Shops	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	Storage Rooms	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	Retail Stores	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14	Industrial Process	NA	0.6	0.8	1.0	1.0	1.0	0.6	0.6	1.0	1.0	0.4	0.8
15	Mechanical / Electrical Room	1.0	NA	1.0	1.0	0.8	0.8	NA	NA	0.8	0.8	NA	NA
16	Janitor's Closet	1.0	NA	1.0	1.0	1.0	1.0	NA	NA	1.0	1.0	NA	NA
17	Lounge / Break Room	1.0	NA	NA	NA	NA	0.8	NA	NA	NA	NA	NA	NA
18	Chemical Analysis Laboratory	1.0	NA	NA	NA	NA	0.7	NA	NA	NA	NA	NA	NA
Exit	Exit Lights	1.0	NA	1.0	1.0	1.0	1.0	NA	NA	1.0	1.0	NA	NA
Extr	Exterior Lighting	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	NA

Table G-3. Lighting Energy Use Factors

Task Code	Description	Scheduled Hours/Week per Building											
		117-1	117-2	117-3	117-4	117-5	117-6	117-6A	117-7	117-8	117-10	117-11	117-15
1	Corridors	96.0	NA	96.0	96.0	96.0	96.0	NA	NA	96.0	96.0	NA	NA
2	Kitchens	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Dining	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4	Offices - General & Classrooms	96.0	NA	96.0	96.0	NA	NA	NA	168	96.0	96.0	NA	NA
5	Conference	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6	Offices - Drafting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	Laundry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	Toilets / Locker Rooms	96.0	NA	96.0	96.0	96.0	96.0	NA	NA	96.0	96.0	NA	NA
9	Sleeping Quarters	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	Supply Rooms	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	Repair Shops	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	Storage Rooms	96.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13	Retail Stores	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14	Industrial Process	NA	24.0	96.0	96.0	96.0	96.0	96.0	168	96.0	96.0	96.0	96.0
15	Mechanical / Electrical Room	4.0	NA	24.0	24.0	96.0	96.0	NA	NA	96.0	96.0	NA	NA
16	Janitor's Closet	12.0	NA	8.0	8.0	12.0	12.0	NA	NA	12.0	12.0	NA	NA
17	Lounge / Break Room	96.0	NA	NA	NA	NA	96.0	NA	NA	NA	NA	NA	NA
18	Chemical Analysis Laboratory	96.0	NA	NA	NA	NA	96.0	NA	NA	NA	NA	NA	NA
Exit	Exit Lights	168	NA	168	168	168	168	NA	NA	168	168	NA	NA
Extr	Exterior Lighting	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	NA

Note: WADF facilities schedules varry depending on the work load. Assume 2 shifts per day, 6 days per week.

Table G-4. Existing Lighting Fixture Electric Demands

Existing Fixture Type Description	Watts per Fixture
F40T12 - 2 Lamps per Fixture - Standard Fixture	86.0
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0
Exit Light: F-6W - 2 Lamps per Fixture	20.0
F40T12 - 1 Lamp per Fixture - Standard Fixture	50.0
F40T12 - 2 Lamps per Fixture - Standard Fixture	86.0
F40T12 - 2 Lamps per Fixture - Industrial Fixture	86.0
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0
F40T12 - 4 Lamps per Fixture - Industrial Fixture	172.0
F48T12VH - 2 Lamps per Fixture - Explosion Proof Fixture	250.0
I-100W - 1 Lamp per Fixture - Ceiling & Wall Mounted	100.0
I-150W - 1 Lamp per Fixture - Ceiling & Wall Mounted	150.0
MV 175W - Pendant-Mount	198.0
MH 400W - Pendant-Mount	460.0

"Standard Fixtures" are either recessed or surface mounted, including lens.

APPENDIX H

Lighting Retrofit Calculations

APPENDIX H
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Lighting Retrofit Calculations

Three types of energy saving retrofits are evaluated for study buildings:

- Lighting fixture delamping, lamp and ballast modifications
- Lighting fixture lamp, ballast and reflector modifications
- Lighting controls modifications

Specific measures evaluated for each type of retrofit include:

Lighting Fixture and Control Retrofits Evaluated

Lighting ECO Number	Description
LD-1	Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast
LD-2	Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast
LF-1	Retrofit LED Lamp Kit in Existing Exit Lights
LF-2	Retrofit Electronic Ballast & 1xF32T8 Lamp in Existing 1-Lamp F40T12 Fixtures
LF-3A	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Standard 2-Lamp F40T12 Fixtures
LF-3B	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Industrial 2-Lamp F40T12 Fixtures
LF-4A	Retrofit Electronic Ballast & 4xF32T8 Lamps in Existing 4-Lamp F40T12 Fixtures, or
LF-4B	Delamp to 2xF32T8 Lamps & Install Reflector & Electronic Ballast in 4-Lamp F40T12 Fixtures
LF-5	Replace 100W Incandescent Lamp and Base with DTT-26W, 2700K, CRI 82 Compact Fluorescent & Ballast
LF-6	Replace 150W Incandescent Lamp and Base with DTT-26W, 2700K, CRI 80 Compact Fluorescent & Ballast
LF-7	Retrofit Existing 175W MV Exterior Light Fixtures with 50W HPS Lamps & Ballasts
LF-8	Retrofit Existing 400W Metal Halide Explosion Proof Fixtures with 250W HPS Lamps & Ballasts
LC-1	Lighting Control Retrofit: Install Ceiling-Mounted Passive Infrared (PIR) Motion Sensors
LC-2	Lighting Control Retrofit: Install Ceiling-Mounted Ultrasonic Motion Sensors
LC-3	Lighting Control Retrofit: Replace Wall Switches with Passive Infrared (PIR) Motion Sensor Switches

Results of economic evaluations are summarized on Table H-1. Calculations for each project appear on Tables H-2 through H-13. Detailed cost estimates, Life Cycle Cost Analysis summary sheets and catalog data for selected components are appended.

Fixture Delamping and Modification Evaluations

Delamping is considered for rooms audited with excessive levels of illumination according to Illumination Engineering Society guidance.

Delamping of two- and four-lamp F40T12 fixtures is considered, including retrofitting with F32T8 lamps and electronic ballasts. Half of the lamps are removed in each of the two delamping projects.

Detailed calculations appear on Table H-2.

Fixture Retrofit Evaluations

Lighting fixture modifications are considered. Existing fluorescent fixtures use 40-watt T12 fluorescent lamps and standard ballasts. Room-by-room calculations of fixture modifications evaluated for study buildings appear as Tables H-3 through H-10.

Retrofit LF-1 proposes to replace existing 6-watt fluorescent lamps in exit signs with light emitting diode (LED) lamp kits.

Retrofits LF-2, LF-3A, LF-3B, and LF-4A are one-for-one fluorescent lamp and ballast replacements in existing fixtures. Retrofitting existing one-lamp fluorescent fixtures with electronic ballasts and 32-watt T8 lamps, for example, will reduce fixture input power by about 19 watts if standard core and coil ballasts are installed in existing fixtures.

Retrofit LF-4B involves installing a reflector and delamping existing 4-lamp fluorescent fixtures to two F32T8 lamps with electronic ballast. Retrofits LF-4A and LF-4B are evaluated for the same fixtures. The retrofit with the best economic analysis results is recommended.

Retrofits LF-5 and LF-6 are evaluated for replacing existing incandescent lamps in various fixtures with compact fluorescent lamps and ballasts. These retrofits involve modifying the fixtures such that only compact fluorescent lamps may be used.

Retrofit LF-7 involves the replacement of existing mercury vapor lamps with high pressure sodium lamps and ballasts.

Retrofit LF-8 replaces metal halide lamps with high pressure sodium lamps and ballasts.

Pricing shown on the attached unit cost estimates are taken, in large part, from the February 1994 issue of "Defense General Supply Center - Energy Efficient Lighting Catalog". Components are available at prices listed in this document to DoD agencies; it is assumed that contractor pricing would be similar. Catalog numbers are indicated on unit cost estimates.

Energy use for the existing fixtures is calculated in Appendix G. Energy savings and economic analysis calculations for proposed fixture retrofits use the following calculation methodology:

Lighting Retrofit Evaluation Calculations

Label	Contents / Calculation Explanation
KW_SVD	(E_KW) — (S_KW) = Demand savings (kW) from lighting retrofit — Difference in "Watts per Fixture" values in Tables H-14 and H-15 (See note below)
KWH_SV	KW_SVD * HR/WK * 52 * Demand Factor = = Electric savings from retrofit — Usage Schedule (HR/WK) and Demand Schedule are provided in Appendix G.
DEM_$/Y	KW_SVD * $8.517 per kW-Mo * 12 Months per Year = = Annual electric demand cost savings (Sierra Pacific demand charge, including Taxes)
USE_$/Y	KWH_SVD * $0.0438 = Annual electric power cost savings (Sierra Pacific power use charge, including Taxes)
PWR_LCC $	[DEM_$/Y + USE_$/Y] * 12.02 = Life cycle savings, Life of 15 years; UPV
O&M_$/Y	[Table H-14 $/1000 LAMP-Hr - Table H-15 $/1000 LAMP-Hr] * HR/WK * 52 * * No. FXTRS * NO. LAMPS / 1000 = Annual O&M savings (additional cost) for lamp replacements; refer to Tables H-14 and H-15
O&M_LCC $	(O&M_$/Y * 11.94) = Life cycle O&M cost for Life of 15 years; UPV
TOT_$/Y	(DEM_$/Y + USE_$/Y + O&M_$/Y) = Total annual cost savings
TOT_LCC$	(O&M_LCC$ + PWR_LCC$) = Total life cycle cost savings
CONST$	Retrofit Unit Cost * NO. FIXTURES = Construction cost from retrofit unit cost estimates, attached
SIOH	CONST$ * 0.120 = SIOH and design at 6% each of construction cost
INVE$T	CONST$ + SIOH = Total investment per ECIP guidance
SIR	(TOT_LCC$) / (INVE$T) = Savings-to-investment ratio
PAYBCK	(INVE$T) / (TOT_$/Y) = Payback period (years)

Notes: Parameters shown above for existing and retrofit (savings) cases are indicated by prefixes: "E_" and "S_", respectively, corresponding to labels used above to explain lighting energy use calculations. Refer to Tables H-14 and H-15 for existing and proposed retrofit energy use and O&M costs.

Sierra Pacific Power Company presently has no rebate programs in effect.

Controls Retrofit Evaluations

Lighting control retrofits evaluated involve installing occupancy sensor switching in offices, conference rooms, bathrooms and other areas where lights are normally turned on for periods when no one is present. Three types of occupancy sensors are considered. A wall switch type passive infrared (PIR) sensor is evaluated as Retrofit LC-3. This is the least expensive control retrofit investigated and simply replaces a small office's toggle switch. For larger offices and open areas, ceiling mounted sensors are evaluated. Ceiling mounted switches are more expensive since a relay and additional wiring are required.

Retrofit LC-1 proposes single or multiple ceiling-mounted PIR sensors for larger rooms. Retrofit LC-2 evaluates ceiling-mounted ultrasonic occupancy sensors for bathrooms and toilets and other rooms where PIR sensors cannot "see" over partitions.

Detailed evaluations appear as Tables H-11 through H-13.

The percent savings anticipated for each room or area is listed on Tables H-11 through H-13. Energy savings of at least these levels have been achieved in many similar retrofits according to electric utility companies. Savings percentages used may be low for many offices observed during field investigations conducted for the study. In several buildings, many rooms were observed to be unoccupied at least 50 percent of the time (with lights left on). Manufacturers of occupancy sensor switches report savings of between 35 percent and 75 percent depending on the application. Therefore, all of the savings assumptions in these analyses may be considered conservative, since the savings percentages are at the lower end, or below the range of savings found by manufacturers.

Energy and cost savings are determined using the same formulae as are shown above for lighting energy use calculations. Energy consumption is factored down based on the assumed percent savings.

Table H-1. Summary of Lighting and Controls Retrofit Evaluations

Lighting ECO Number	Description	Number Retrofit Units	Demand Saved (kW)	Energy Saved (kWH/Year)	Electric Demand ($/Year)	Electric Usage ($/Year)	O&M Saved ($/Year)	Total LCC Cost Saved ($)	ECO Investment ($)	SIR	Payback (Years)
LD-1	Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast	4	0.22	879	$22.49	$38.44	$6.89	$815	$302	2.69	4.46
LD-2	Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast	57	6.33	22,109	$647	$967	$196	$21,745	$5,268	4.13	2.91
LF-1	Retrofit LED Lamp Kit in Existing Exit Lights	81	1.47	12,879	$151	$563	($56.60)	$7,908	$6,037	1.31	9.18
LF-2	Retrofit Electronic Ballast & 1xF32T8 Lamp in Existing 1-Lamp F40T12 Fixtures	26	0.49	858	$50	$38	($1.12)	$1,045	$1,791	0.58	20.60
LF-3A	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Standard 2-Lamp F40T12 Fixtures	187	4.68	18,592	$478	$813	($32)	$15,133	$15,144	1.00	12.03
LF-3B	Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Industrial 2-Lamp F40T12 Fixtures	324	8.10	21,890	$828	$958	($29)	$21,118	$24,973	0.85	14.22
LF-4A	Retrofit Electronic Ballast & 4xF32T8 Lamps in Existing 4-Lamp F40T12 Fixtures, or	118	5.90	24,448	$603.01	$1,070	($36)	$19,671	$18,190	1.08	11.12
LF-4B	Delamp to 2xF32T8 Lamps & Install Reflector & Electronic Ballast in 4-Lamp F40T12 Fixtures	118	13.10	54,275	$1,339	$2,375	$371	$49,069	$9,925	4.94	2.43
LF-5	Replace 100W Incandescent lamp and base with DTT-26W, 2700K, CRI 82 Compact Fluorescent & Ballast	6	0.39	1,366	$40	$60	$63	$1,953	$309	6.33	1.90
LF-6	Replace 150W Incandescent lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent & Ballast	3	0.35	215	$35	$9	$6	$604	$154	3.91	3.07
LF-7	Retrofit Existing 175W MV Exterior Light Fixtures with 50W HPS Lamps & Ballasts	138	16.28	71,129	$1,664	$3,112	($261)	$54,297	$24,991	2.17	5.53
LF-8	Retrofit Existing 400W Metal Halide Explosion Proof Fixtures with 250W HPS Lamps & Ballasts	48	7.68	38,818	$785	$1,698	$175	$31,934	$10,980	2.91	4.13
LC-1	Lighting Control Retrofit: Install Ceiling Mounted Passive Infrared (PIR) Motion Sensors	24	0.00	9,715	$0	$425	$0	$5,109	$9,566	0.53	22.51
LC-2	Lighting Control Retrofit: Install Ceiling Mounted Ultrasonic Motion Sensors	17	0.00	2,969	$0	$130	$0	$1,561	$6,776	0.23	52.16
LC-3	Lighting Control Retrofit: Replace Wall-Switches with Passive Infrared (PIR) Motion Sensor Switches	19	0.00	4,888	$0	$214	$0	$2,571	$2,269	1.13	10.61
Total Successful Lighting Fixture and Controls Retrofits		661	50.5	225,149	$5,161	$9,851	$468	$186,029	$75,380	2.47	4.87

Note: Lighting retrofits LF-4A and LF-4B address the same fixtures; the analysis with the best economics is recommended for implementation.

Table H-2 Delamping and Lighting Retrofit LD-1: 2-Lamp F40T12 to 1-Lamp F32T8 Fixtures

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	21	1	R	F40T12	40	2	86	3	0.8	96	31	0.17	659	$45.69	$5.17	$50.86	$611	$227	2.69	4.46
117-1	Services & Support	24	1	R	F40T12	40	2	86	1	0.8	96	31	0.06	220	$15.23	$1.72	$16.95	$204	$76	2.69	4.46
Totals for ECO LD-1									4				0.22	878.59	$60.93	$6.89	$67.82	$814.59	$302.45	2.69	4.46

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	1	4	R	F40T12	40	4	172	4	0.7	96	61	0.44	1,552	$113.26	$13.78	$127.04	$1,526	$370	4.13	2.91
117-1	Services & Support	21	1	R	F40T12	40	4	172	2	0.8	96	61	0.22	887	$61.48	$6.89	$68.37	$821	$185	4.44	2.70
117-1	Services & Support	22	4	R	F40T12	40	4	172	2	0.7	96	61	0.22	776	$56.63	$6.89	$63.52	$763	$185	4.13	2.91
117-1	Services & Support	23	1	R	F40T12	40	4	172	5	0.8	96	61	0.56	2,216	$153.70	$17.22	$170.92	$2,053	$462	4.44	2.70
117-3	Decontam & Small Parts	Women's Lounge	8	S	F40T12	40	4	172	1	0.6	96	61	0.11	332	$25.89	$3.44	$29.34	$352	$92	3.81	3.15
117-3	Decontam & Small Parts	Control Room	4	R	F40T12	40	4	172	17	0.7	96	61	1.89	6,594	$481.37	$58.56	$539.92	$6,485	$1,571	4.13	2.91
117-4	Bulk Explosives Disposal	Women's Lounge	8	S	F40T12	40	4	172	1	0.6	96	61	0.11	332	$25.89	$3.44	$29.34	$352	$92	3.81	3.15
117-6	Steamout Building	Toilet - Mens'	8	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.89	$58.67	$705	$185	3.81	3.15
117-6	Steamout Building	Toilet - Womens'	8	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.89	$58.67	$705	$185	3.81	3.15
117-6	Steamout Building	Womens' Lounge	8	S	F40T12	40	4	172	1	0.6	96	61	0.11	332	$25.89	$3.44	$29.34	$352	$92	3.81	3.15
117-8	Mech. Removal Building	Men's W/C	8	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.89	$58.67	$705	$185	3.81	3.15
117-8	Mech. Removal Building	Women's W/C	8	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.89	$58.67	$705	$185	3.81	3.15
117-8	Mech. Removal Building	Women's Lounge	8	S	F40T12	40	4	172	1	0.6	96	61	0.11	332	$25.89	$3.44	$29.34	$352	$92	3.81	3.15
117-8	Mech. Removal Building	10, Control Room	4	R	F40T12	40	4	172	10	0.8	96	61	1.11	4,433	$307.40	$34.44	$341.85	$4,106	$924	4.44	2.70
117-10	Preparation Building	Women's W/C	8	R	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.89	$58.67	$705	$185	3.81	3.15
117-10	Preparation Building	Women's Lounge	8	R	F40T12	40	4	172	1	0.6	96	61	0.11	332	$25.89	$3.44	$29.34	$352	$92	3.81	3.15
117-10	Preparation Building	Men's W/C	8	R	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.89	$58.67	$705	$185	3.81	3.15
Totals for ECO LD-2									57				6.33	22109.07	$1,614	$196.34	$1,810	$21,745	$5,268	4.13	2.91

Energy Conservation Opportunity Legend

LD-1	Delamp and Retrofit from 2-Lamp F40T12 Fixture to a	1-Lamp F32T8 Fixture with Electronic Ballast
LD-2	Delamp and Retrofit from 4-Lamp F40T12 Fixture to a	2-Lamp F32T8 Fixture with Electronic Ballast

Table H-3 Lighting Retrofit LF-1: Retrofit Light Emitting Diode (LED) Lamps in Exit Lights

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	Exit Signs	Exit	S	F	6	2	20	9	1.0	168	1.8	0.16	1,431	$79.35	($6.29)	$73.06	$879	$671	1.31	9.18
117-3	Decontam & Small Parts	Exit Signs	Exit	S	F	6	2	20	12	1.0	168	1.8	0.22	1,908	$105.80	($8.39)	$97.41	$1,172	$894	1.31	9.18
117-4	Bulk Explosives Disposal	AG Exit	Exit	S	F	6	2	20	2	1.0	168	1.8	0.04	318	$17.63	($1.40)	$16.24	$195	$149	1.31	9.18
117-4	Bulk Explosives Disposal	UG Exit Signs	Exit	S	F	6	2	20	7	1.0	168	1.8	0.13	1,113	$61.72	($4.89)	$56.83	$683	$522	1.31	9.18
117-5	Refining Building	Exit Signs	Exit	S	F	6	2	20	11	1.0	168	1.8	0.20	1,749	$96.98	($7.69)	$89.30	$1,074	$820	1.31	9.18
117-6	Steamout Building	Exit Signs	Exit	S	F	6	2	20	18	1.0	168	1.8	0.33	2,862	$158.70	($12.58)	$146.12	$1,757	$1,342	1.31	9.18
117-8	Mech. Removal Building	Exit Signs	Exit	S	F	6	2	20	6	1.0	168	1.8	0.11	954	$52.90	($4.19)	$48.71	$586	$447	1.31	9.18
117-10	Preparation Building	Exit Signs	Exit	S	F	6	2	20	16	1.0	168	1.8	0.29	2,544	$141.07	($11.18)	$129.89	$1,562	$1,192	1.31	9.18
Totals for ECO LF-1									81				1.47	12,879	$714.15	($56.60)	$657.55	$7,908	$6,037	1.31	9.18

Table H-4 Lighting Retrofit LF-2: Retrofit Electronic Ballast and 1 x F32T8 Lamp in Existing 1-Lamp F40T12 Fixtures

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	24	1	R	F40T12	40	1	50	1	0.8	96	31	0.02	76	$5.26	($0.09)	$5.17	$62	$69	0.90	13.33
117-2	Boiler Building	Gmd Flr	14	P-Ind	F40T12	40	1	50	19	0.6	24	31	0.36	270	$48.72	($0.45)	$48.27	$580	$1,309	0.44	27.12
117-4	Bulk Explosives Disposal	UG Super's Office	4	S	F40T12	40	1	50	6	0.9	96	31	0.11	512	$34.06	($0.57)	$33.49	$403	$413	0.97	12.34
Totals for ECO LF-2									26				0.49	858	$88.05	($1.12)	$86.93	$1,045	$1,791	0.58	20.60

Table H-5 Lighting Retrofits LF-3A AND LF-3B: Retrofit Electronic Ballasts and F32T8 Lamps in Existing 2-Lamp F40T12 2-Lamp Standard and Industrial Type Fixtures

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	4	18	R	F40T12	40	2	86	12	1.0	96	61	0.30	1,498	$96.19	($2.10)	$94.09	$1,131	$972	1.16	10.33
117-1	Services & Support	6	18	R	F40T12	40	2	86	4	1.0	96	61	0.10	499	$32.06	($0.70)	$31.36	$377	$324	1.16	10.33
117-1	Services & Support	7	18	R	F40T12	40	2	86	12	1.0	96	61	0.30	1,498	$96.19	($2.10)	$94.09	$1,131	$972	1.16	10.33
117-1	Services & Support	9	17	R	F40T12	40	2	86	22	1.0	96	61	0.55	2,746	$176.34	($3.84)	$172.50	$2,074	$1,782	1.16	10.33
117-1	Services & Support	10	8	R	F40T12	40	2	86	3	0.6	96	61	0.08	225	$17.49	($0.52)	$16.97	$204	$243	0.84	14.32
117-1	Services & Support	11	8	R	F40T12	40	2	86	3	0.6	96	61	0.08	225	$17.49	($0.52)	$16.97	$204	$243	0.84	14.32
117-1	Services & Support	12	8	R	F40T12	40	2	86	14	0.6	96	61	0.35	1,048	$81.64	($2.45)	$79.19	$952	$1,134	0.84	14.32
117-1	Services & Support	13	8	R	F40T12	40	2	86	3	0.6	96	61	0.08	225	$17.49	($0.52)	$16.97	$204	$243	0.84	14.32
117-1	Services & Support	14	8	R	F40T12	40	2	86	12	0.6	96	61	0.30	899	$69.98	($2.10)	$67.88	$816	$972	0.84	14.32
117-1	Services & Support	15	8	R	F40T12	40	2	86	3	0.6	96	61	0.08	225	$17.49	($0.52)	$16.97	$204	$243	0.84	14.32
117-1	Services & Support	16	1	R	F40T12	40	2	86	1	0.8	96	61	0.03	100	$6.92	($0.17)	$6.75	$81	$81	1.00	12.00
117-1	Services & Support	17	8	R	F40T12	40	2	86	1	0.6	96	61	0.03	75	$5.83	($0.17)	$5.66	$68	$81	0.84	14.32
117-1	Services & Support	25	1	R	F40T12	40	2	86	1	0.8	96	61	0.03	100	$6.92	($0.17)	$6.75	$81	$81	1.00	12.00
117-1	Services & Support	26	1	R	F40T12	40	2	86	1	0.8	96	61	0.03	100	$6.92	($0.17)	$6.75	$81	$81	1.00	12.00
117-1	Services & Support	27	16	R	F40T12	40	2	86	1	1.0	12	61	0.03	16	$3.24	($0.02)	$3.22	$39	$81	0.48	25.18
117-1	Services & Support	28	1	R	F40T12	40	2	86	1	0.8	96	61	0.03	100	$6.92	($0.17)	$6.75	$81	$81	1.00	12.00
117-1	Services & Support	28	12	R	F40T12	40	2	86	1	0.7	96	61	0.03	87	$6.38	($0.17)	$6.20	$75	$81	0.92	13.06
117-1	Services & Support	32	12	R	F40T12	40	2	86	1	0.7	96	61	0.03	87	$6.38	($0.17)	$6.20	$75	$81	0.92	13.06
117-1	Services & Support	33	12	S	F40T12	40	2	86	4	0.7	96	61	0.10	349	$25.51	($0.70)	$24.81	$298	$324	0.92	13.06
117-1	Services & Support	34	12	S	F40T12	40	2	86	2	0.7	96	61	0.05	175	$12.75	($0.35)	$12.41	$149	$162	0.92	13.06
117-1	Services & Support	35	12	S	F40T12	40	2	86	2	0.7	96	61	0.05	175	$12.75	($0.35)	$12.41	$149	$162	0.92	13.06
117-1	Services & Support	36	12	S	F40T12	40	2	86	4	0.7	96	61	0.10	349	$25.51	($0.70)	$24.81	$298	$324	0.92	13.06
117-1	Services & Support	2&3	18	S	F40T12	40	2	86	2	1.0	96	61	0.05	250	$16.03	($0.35)	$15.68	$189	$162	1.16	10.33
117-1	Services & Support	Exterior	Extr	S	F40T12	40	2	86	2	1.0	84	61	0.05	218	$14.67	($0.31)	$14.36	$173	$162	1.07	11.28
117-3	Decontam & Small Parts	Inert Storage	14	P	F40T12	40	2	86	32	0.8	96	61	0.80	3,195	$221.55	($5.59)	$215.96	$2,596	$2,591	1.00	12.00
117-5	Refining Building	Toilet - Mens'	8	S	F40T12	40	2	86	3	0.6	96	61	0.08	225	$17.49	($0.52)	$16.97	$204	$243	0.84	14.32
117-5	Refining Building	Corridor	1	S	F40T12	40	2	86	1	0.7	96	61	0.03	87	$6.38	($0.17)	$6.20	$75	$81	0.92	13.06
117-5	Refining Building	Toilet - Womens'	8	S	F40T12	40	2	86	2	0.6	96	61	0.05	150	$11.66	($0.35)	$11.31	$136	$162	0.84	14.32

Table H-5 Lighting Retrofits LF-3A AND LF-3B: Retrofit Electronic Ballasts and F32T8 Lamps in Existing 2-Lamp F40T12 2-Lamp Standard and Industrial Type Fixtures

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-5	Refining Building	Lounge - Women's	8	S	F40T12	40	2	86	1	0.6	96	61	0.03	75	$5.83	($0.17)	$5.66	$68	$81	0.84	14.32
117-6	Steamout Building	Mechanics Brk. Room	17	P	F40T12	40	2	86	36	0.8	96	61	0.90	3,594	$249.24	($6.29)	$242.95	$2,921	$2,915	1.00	12.00
Totals for ECO LF-3A: Standard Fixtures									187				4.68	18,592	$1,291	($32.48)	$1,258.80	$15,133	$15,144	1.00	12.03

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	31	16	P-Ind	F40T12	40	2	86	1	1.0	12	61	0.03	16	$3.24	($0.02)	$3.22	$39	$77	0.50	23.93
117-1	Services & Support	30, Mech	15	P-Ind	F40T12	40	2	86	9	1.0	4	61	0.23	47	$25.04	($0.05)	$25.00	$300	$694	0.43	27.75
117-2	Boiler Building	Basement-Wtr Trtmnt	14	P-Ind	F40T12	40	2	86	23	0.6	24	61	0.58	431	$77.61	($0.75)	$76.86	$924	$1,773	0.52	23.06
117-2	Boiler Building	Basement-Open Area	14	P-Ind	F40T12	40	2	86	19	0.6	24	61	0.48	356	$64.11	($0.62)	$63.49	$763	$1,464	0.52	23.06
117-3	Decontam & Small Parts	Mechanical Room	15	P-Ind	F40T12	40	2	86	56	1.0	24	61	1.40	1,747	$219.53	($1.82)	$217.72	$2,617	$4,316	0.61	19.83
117-4	Bulk Explosives Disposal	UG Mech Room	15	P-Ind	F40T12	40	2	86	34	1.0	24	61	0.85	1,061	$133.29	($1.10)	$132.18	$1,589	$2,621	0.61	19.83
117-5	Refining Building	Mechanical Room	15	P-Ind	F40T12	40	2	86	40	0.8	96	61	1.00	3,994	$276.94	($5.19)	$271.75	$3,267	$3,083	1.06	11.35
117-6	Steamout Building	Mechanical Room North	15	P-Ind	F40T12	40	2	86	42	0.8	96	61	1.05	4,193	$290.79	($5.45)	$285.33	$3,430	$3,237	1.06	11.35
117-6A	Pump Building	Pumps	14	P-Ind	F40T12	40	2	86	10	0.6	96	61	0.25	749	$58.31	($1.30)	$57.02	$685	$771	0.89	13.52
117-7	Water Treatment	Basement Pump Room	14	P-Ind	F40T12	40	2	86	10	0.6	168	61	0.25	1,310	$82.89	($2.27)	$80.61	$969	$771	1.26	9.56
117-8	Mech. Removal Building	Mechanical Room	15	P-Ind	F40T12	40	2	86	25	0.8	96	61	0.63	2,496	$173.09	($3.24)	$169.84	$2,042	$1,927	1.06	11.35
117-10	Preparation Building	Mechanical Room	15	P-Ind	F40T12	40	2	86	55	0.8	96	61	1.38	5,491	$380.79	($7.14)	$373.65	$4,492	$4,239	1.06	11.35
Totals for ECO LF-3B: Industrial Fixtures									324				8.10	21,890	$1,786	($28.94)	$1,757	$21,118	$24,973	0.85	14.22

LF-3A: Retrofit Electronic Ballast & 2 x F32T8 Lamps in Existing Standard 2-Lamp F40T12 Fixtures
LF-3B: Retrofit Electronic Ballast & 2 x F32T8 Lamps in Existing Industrial 2-Lamp F40T12 Fixtures

Table H-6 Lighting Retrofit LF-4A and LF-4B: Retrofit 4-Lamp F40T12 Fixtures either with 4 x F32T8 Lamps and Electronic Ballast or Retrofit Reflector and Delamp to 2 x F32T8 Lamps and Electronic Ballast

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (KWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	5	18	R	F40T12	40	4	172	16	1.0	96	122	0.80	3,994	$256.50	($4.79)	$251.71	$3,026	$2,466	1.23	9.80
117-1	Services & Support	18	4	R	F40T12	40	4	172	2	0.7	96	122	0.10	349	$25.51	($0.60)	$24.91	$299	$308	0.97	12.38
117-1	Services & Support	19	4	R	F40T12	40	4	172	2	0.7	96	122	0.10	349	$25.51	($0.60)	$24.91	$299	$308	0.97	12.38
117-1	Services & Support	20	4	R	F40T12	40	4	172	15	0.7	96	122	0.75	2,621	$191.32	($4.49)	$186.84	$2,246	$2,312	0.97	12.38
117-3	Decontam & Small Parts	Supervisor Office	4	R	F40T12	40	4	172	9	0.7	96	122	0.45	1,572	$114.79	($2.69)	$112.10	$1,348	$1,387	0.97	12.38
117-3	Decontam & Small Parts	Corridor	1	S	F40T12	40	4	172	2	1.0	96	122	0.10	499	$32.06	($0.60)	$31.46	$378	$308	1.23	9.80
117-3	Decontam & Small Parts	Men's W/C	8	S	F40T12	40	4	172	2	0.6	96	122	0.10	300	$23.33	($0.60)	$22.73	$273	$308	0.89	13.57
117-3	Decontam & Small Parts	Women's W/C	8	S	F40T12	40	4	172	2	0.6	96	122	0.10	300	$23.33	($0.60)	$22.73	$273	$308	0.89	13.57
117-4	Bulk Explosives Disposal	UG Control Room	4	R	F40T12	40	4	172	17	0.9	96	122	0.85	3,819	$253.96	($5.09)	$248.88	$2,992	$2,621	1.14	10.53
117-4	Bulk Explosives Disposal	UG Toilet - Women	8	S	F40T12	40	4	172	2	0.6	96	122	0.10	300	$23.33	($0.60)	$22.73	$273	$308	0.89	13.57
117-4	Bulk Explosives Disposal	UG Corridor	1	S	F40T12	40	4	172	2	0.8	96	122	0.10	399	$27.69	($0.60)	$27.10	$326	$308	1.06	11.38
117-4	Bulk Explosives Disposal	UG Toilet - Men	8	S	F40T12	40	4	172	2	0.6	96	122	0.10	300	$23.33	($0.60)	$22.73	$273	$308	0.89	13.57
117-6	Steamout Building	Corridor	1	S	F40T12	40	4	172	4	0.6	96	122	0.20	599	$46.65	($1.20)	$45.45	$546	$617	0.89	13.57
117-6	Steamout Building	Lab	18	R	F40T12	40	4	172	7	0.7	96	122	0.35	1,223	$89.28	($2.09)	$87.19	$1,048	$1,079	0.97	12.38
117-7	Water Treatment	Control Rm	4	S	F40T12	40	4	172	5	1.0	168	122	0.25	2,184	$121.11	($2.62)	$118.49	$1,424	$771	1.85	6.50
117-8	Mech. Removal Building	Supervisor's Office	4	R	F40T12	40	4	172	2	0.8	96	122	0.10	399	$27.69	($0.60)	$27.10	$326	$308	1.06	11.38
117-8	Mech. Removal Building	Corridor	1	S	F40T12	40	4	172	2	0.6	96	122	0.10	300	$23.33	($0.60)	$22.73	$273	$308	0.89	13.57
117-10	Preparation Building	Corridor	1	R	F40T12	40	4	172	2	0.7	96	122	0.10	349	$25.51	($0.60)	$24.91	$299	$308	0.97	12.38
117-10	Preparation Building	Control Rm	4	R	F40T12	40	4	172	15	0.8	96	122	0.75	2,995	$207.70	($4.49)	$203.22	$2,443	$2,312	1.06	11.38
117-10	Preparation Building	Supervisor's Office	4	R	F40T12	40	4	172	8	0.8	96	122	0.40	1,597	$110.78	($2.39)	$108.38	$1,303	$1,233	1.06	11.38
Totals for ECO LF-4A									118				5.90	24,448	$1,673	($36.42)	$1,636.29	$19,671	$18,190	1.08	11.12

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (KWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	5	18	R	F40T12	40	4	172	16	1.0	96	61	1.78	8,866	$569.42	$48.80	$618.23	$7,427	$1,346	5.52	2.18
117-1	Services & Support	18	4	R	F40T12	40	4	172	2	0.7	96	61	0.22	776	$56.63	$6.10	$62.73	$754	$168	4.48	2.68
117-1	Services & Support	19	4	R	F40T12	40	4	172	2	0.7	96	61	0.22	776	$56.63	$6.10	$62.73	$754	$168	4.48	2.68
117-1	Services & Support	20	4	R	F40T12	40	4	172	15	0.7	96	61	1.67	5,818	$424.74	$45.75	$470.49	$5,652	$1,262	4.48	2.68

Table H-6 Lighting Retrofit LF-4A and LF-4B: Retrofit 4-Lamp F40T12 Fixtures either with 4 x F32T8 Lamps and Electronic Ballast or Retrofit Reflector and Delamp to 2 x F32T8 Lamps and Electronic Ballast

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-3	Decontam & Small Parts	Supervisor Office	4	R	F40T12	40	4	172	9	0.7	96	61	1.00	3,491	$254.84	$27.45	$282.29	$3,391	$757	4.48	2.68
117-3	Decontam & Small Parts	Corridor	1	S	F40T12	40	4	172	2	1.0	96	61	0.22	1,108	$71.18	$6.10	$77.28	$928	$168	5.52	2.18
117-3	Decontam & Small Parts	Men's W/C	8	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.10	$57.88	$695	$168	4.13	2.91
117-3	Decontam & Small Parts	Women's W/C	8	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.10	$57.88	$695	$168	4.13	2.91
117-4	Bulk Explosives Disposal	UG Control Room	4	R	F40T12	40	4	172	17	0.9	96	61	1.89	8,478	$563.80	$51.86	$615.65	$7,396	$1,430	5.17	2.32
117-4	Bulk Explosives Disposal	UG Toilet - Women	8	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.10	$57.88	$695	$168	4.13	2.91
117-4	Bulk Explosives Disposal	UG Corridor	1	S	F40T12	40	4	172	2	0.8	96	61	0.22	887	$61.48	$6.10	$67.58	$812	$168	4.83	2.49
117-4	Bulk Explosives Disposal	UG Toilet - Men	8	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.10	$57.88	$695	$168	4.13	2.91
117-6	Steamout Building	Corridor	1	S	F40T12	40	4	172	4	0.6	96	61	0.44	1,330	$103.57	$12.20	$115.77	$1,391	$336	4.13	2.91
117-6	Steamout Building	Lab	18	R	F40T12	40	4	172	7	0.7	96	61	0.78	2,715	$198.21	$21.35	$219.56	$2,637	$589	4.48	2.68
117-7	Water Treatment	Control Rm	4	S	F40T12	40	4	172	5	1.0	168	61	0.56	4,848	$268.86	$26.69	$295.55	$3,550	$421	8.44	1.42
117-8	Mech. Removal Building	Supervisor's Office	4	R	F40T12	40	4	172	2	0.8	96	61	0.22	887	$61.48	$6.10	$67.58	$812	$168	4.83	2.49
117-8	Mech. Removal Building	Corridor	1	S	F40T12	40	4	172	2	0.6	96	61	0.22	665	$51.78	$6.10	$57.88	$695	$168	4.13	2.91
117-10	Preparation Building	Corridor	1	R	F40T12	40	4	172	2	0.7	96	61	0.22	776	$56.63	$6.10	$62.73	$754	$168	4.48	2.68
117-10	Preparation Building	Control Rm	4	R	F40T12	40	4	172	15	0.8	96	61	1.67	6,649	$461.10	$45.75	$506.86	$6,089	$1,262	4.83	2.49
117-10	Preparation Building	Supervisor's Office	4	R	F40T12	40	4	172	8	0.8	96	61	0.89	3,546	$245.92	$24.40	$270.32	$3,247	$673	4.83	2.49
Totals for ECO LF-4B									118				13.10	54,275	$3,713	$371.38	$4,084.78	$49,069	$9,925	4.94	2.43

LF-4A: Retrofit Electronic Ballasts & 4 x F32T8 Lamps in Existing 4-Lamp F40T12 Fixtures, or
LF-4B: Retrofit Reflector and Delamp Existing 4-Lamp F40T12 Fixtures to 2 x F32T8 Lamps with Electronic Ballasts

Table H-7 Lighting Retrofit LF-5: Modify 100 Watt Incandescent Fixtures for DTT-26 Watt Compact Fluorescent Lamps

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-3	Decontam & Small Parts	Janitor's Closet	16	S	I	100	1	100	1	1.0	8	35	0.07	27	$7.83	$1.25	$9.08	$109	$51	2.12	5.67
117-4	Bulk Explosives Disposal	AG Roof	14	P-ExP	I	100	1	100	4	1.0	96	35	0.26	1,298	$83.36	$60.16	$143.53	$1,720	$206	8.36	1.43
117-4	Bulk Explosives Disposal	UG Janitor Closet	16	S	I	100	1	100	1	1.0	8	35	0.07	27	$7.83	$1.25	$9.08	$109	$51	2.12	5.67
117-5	Refining Building	Janitor's Closet	16	S	I	100	1	100	1	1.0	12	35	0.07	41	$8.42	$1.88	$10.30	$124	$51	2.40	5.00
Totals for ECO LF-5									6				0.39	1,366	$99.61	$63.30	$162.90	$1,953	$309	6.33	1.90

Table H-8 Lighting Retrofit LF-6: Modify 150 Watt Incandescent Fixtures for DTT-26 Watt Compact Fluorescent Lamps

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-6	Steamout Building	Janitor's Closet	16	S	I	150	1	150	1	1.0	12	35	0.12	72	$14.89	$1.88	$16.77	$201	$51	3.91	3.07
117-8	Mech. Removal Building	Jan Closet	16	S	I	150	1	150	1	1.0	12	35	0.12	72	$14.89	$1.88	$16.77	$201	$51	3.91	3.07
117-10	Preparation Building	Janitor's Closet	16	S	I	150	1	150	1	1.0	12	35	0.12	72	$14.89	$1.88	$16.77	$201	$51	3.91	3.07
Totals for ECO LF-6									3				0.35	215	$44.68	$5.64	$50.32	$604	$154	3.91	3.07

Table H-9 Lighting Retrofit LF-7: Retrofit Existing 175 Watt Mercury Vapor Fixtures with 50 Watt High Pressure Sodium Lamps and Ballasts

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	Exterior	Extr	S	MV	175	1	198	4	1.0	84	80	0.47	2,062	$138.45	($7.56)	$130.88	$1,574	$724	2.17	5.53
117-2	Boiler Building	Exterior	Extr	S	MV	175	1	198	20	1.0	84	80	2.36	10,308	$692.23	($37.82)	$654.41	$7,869	$3,622	2.17	5.53
117-3	Decontam & Small Parts	Exterior	Extr	S	MV	175	1	198	43	1.0	84	80	5.07	22,163	$1,488	($81.31)	$1,406.99	$16,919	$7,787	2.17	5.53
117-4	Bulk Explosives Disposal	Exterior	Extr	S	MV	175	1	198	3	1.0	84	80	0.35	1,546	$103.84	($5.67)	$98.16	$1,180	$543	2.17	5.53
117-4	Bulk Explosives Disposal	Exterior	Extr	S	MV	175	1	198	2	1.0	84	80	0.24	1,031	$69.22	($3.78)	$65.44	$787	$362	2.17	5.53
117-5	Refining Building	Exterior	Extr	S	MV	175	1	198	16	1.0	84	80	1.89	8,247	$553.79	($30.26)	$523.53	$6,295	$2,898	2.17	5.53
117-6	Steamout Building	Exterior	Extr	S	MV	175	1	198	15	1.0	84	80	1.77	7,731	$519.18	($28.36)	$490.81	$5,902	$2,716	2.17	5.53
117-6A	Pump Building	Exterior	Extr	S	MV	175	1	198	3	1.0	84	80	0.35	1,546	$103.84	($5.67)	$98.16	$1,180	$543	2.17	5.53
117-7	Water Treatment	Exterior	Extr	S	MV	175	1	198	5	1.0	84	80	0.59	2,577	$173.06	($9.45)	$163.60	$1,967	$905	2.17	5.53
117-8	Mech. Removal Building	Exterior	Extr	S	MV	175	1	198	9	1.0	84	80	1.06	4,639	$311.51	($17.02)	$294.49	$3,541	$1,630	2.17	5.53
117-10	Preparation Building	Exterior	Extr	S	MV	175	1	198	15	1.0	84	80	1.77	7,731	$519.18	($28.36)	$490.81	$5,902	$2,716	2.17	5.53
117-11	Accumulator Building	Exterior	Extr	S	MV	175	1	198	3	1.0	84	80	0.35	1,546	$103.84	($5.67)	$98.16	$1,180	$543	2.17	5.53
Totals for ECO LF-7									138				16.28	71,129	$4,776	($260.96)	$4,515.46	$54,297	$24,991	2.17	5.53

Table H-10 Lighting Retrofit LF-8: Retrofit Existing 400 Watt Metal Halide Fixtures with 250 Watt High Pressure Sodium Lamps and Ballasts

Building Number	Building Name	Room No / Name	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Watts/ECO Fixture	Demand Saved (kW)	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-4	Bulk Explosives Disposal	AG Cell 1	14	P-ExP	MH	400	1	460	8	1.0	96	300	1.28	6,390	$410.40	$24.49	$434.89	$5,225	$1,830	2.86	4.21
117-4	Bulk Explosives Disposal	AG Cell 2	14	P-ExP	MH	400	1	460	8	1.0	96	300	1.28	6,390	$410.40	$24.49	$434.89	$5,225	$1,830	2.86	4.21
117-5	Refining Building	Top Level Processing	14	P-ExP	MH	400	1	460	8	1.0	96	300	1.28	6,390	$410.40	$24.49	$434.89	$5,225	$1,830	2.86	4.21
117-6	Steamout Building	South Tower	14	P-ExP	MH	400	1	460	12	1.0	96	300	1.92	9,585	$615.59	$36.74	$652.33	$7,838	$2,745	2.86	4.21
117-7	Water Treatment	Filter Room	14	P-ExP	MH	400	1	460	9	0.6	168	300	1.44	7,548	$477.42	$48.22	$525.64	$6,314	$2,059	3.07	3.92
117-7	Water Treatment	Chem Tanks	14	P-ExP	MH	400	1	460	3	0.6	168	300	0.48	2,516	$159.14	$16.07	$175.21	$2,105	$686	3.07	3.92
Totals for ECO LF-8									48				7.68	38,818	$2,483	$174.52	$2,657.86	$31,934	$10,980	2.91	4.13

Table H-11 Lighting Control Retrofit LC-1: Ceiling Mounted Passive Infrared (PIR) Motion Sensors

Building Number	Building Name	Room No / Name	ECO Included	Task Code	Type Code	Lamp Type	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Sensor Savings (%)	Number of Sensors	Use Saved (kWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	4	-	18	R	F40T12	2	86	12	1.0	96	20%	2	1,030	$45.08	$0.00	$45.08	$542	$797	0.68	17.68
117-1	Services & Support	5	LF-4B	18	R	F32T8	2	61	16	1.0	96	20%	3	974	$42.63	$0.00	$42.63	$512	$1,196	0.43	28.05
117-1	Services & Support	9	-	17	R	F40T12	2	86	22	1.0	96	30%	4	2,833	$123.97	$0.00	$123.97	$1,490	$1,594	0.93	12.86
117-1	Services & Support	14	-	8	R	F40T12	2	86	12	0.6	96	35%	2	1,082	$47.34	$0.00	$47.34	$569	$797	0.71	16.84
117-1	Services & Support	20	LF-4B	4	R	F32T8	2	61	15	0.7	96	30%	2	959	$41.97	$0.00	$41.97	$504	$797	0.63	18.99
117-3	Decontam & Small Parts	Supervisor Office	LF-4B	4	R	F32T8	2	61	9	0.7	96	30%	1	576	$25.18	$0.00	$25.18	$303	$399	0.76	15.83
117-3	Decontam & Small Parts	Corridor	LF-4B	1	S	F32T8	2	61	2	1.0	96	25%	2	152	$6.66	$0.00	$6.66	$80	$797	0.10	119.67
117-4	Bulk Explosives Disposal	UG Corridor	LF-4B	1	S	F32T8	2	61	2	0.8	96	25%	1	122	$5.33	$0.00	$5.33	$64	$399	0.16	74.79
117-5	Refining Building	Corridor	-	1	S	F40T12	2	86	1	0.7	96	25%	1	75	$3.29	$0.00	$3.29	$40	$399	0.10	121.26
117-6	Steamout Building	Corridor	LF-4B	1	S	F32T8	2	61	4	0.6	96	25%	1	183	$7.99	$0.00	$7.99	$96	$399	0.24	49.86
117-7	Water Treatment	Control Rm	LF-4B	4	S	F32T8	2	61	5	1.0	168	30%	1	799	$34.97	$0.00	$34.97	$420	$399	1.05	11.40
117-8	Mech. Removal Building	Supervisor's Office	LF-4B	4	R	F32T8	2	61	2	0.8	96	30%	1	146	$6.40	$0.00	$6.40	$77	$399	0.19	62.33
117-8	Mech. Removal Building	Corridor	LF-4B	1	S	F32T8	2	61	2	0.6	96	25%	1	91	$4.00	$0.00	$4.00	$48	$399	0.12	99.72
117-10	Preparation Building	Corridor	LF-4B	1	R	F32T8	2	61	2	0.7	96	25%	1	107	$4.66	$0.00	$4.66	$56	$399	0.14	85.48
117-10	Preparation Building	Supervisor's Office	LF-4B	4	R	F32T8	2	61	8	0.8	96	30%	1	585	$25.58	$0.00	$25.58	$307	$399	0.77	15.58
Totals for ECO LC-1													24	9,715	$425	$0.00	$425.06	$5,109	$9,566	0.53	22.51

Ceiling Mounted PIR controls are suitable for conference rooms and larger open offices and other rooms.
Savings are assumed to be at the lower end, or below, savings ranges claimed by manufacturers of motion sensor controls, based on performance of actual installed systems.
Delamping and fixture retrofit ECOs with SIRs above 1.0 are assumed implemented prior to evaluation of energy savings for lighting control retrofit ECOs. This avoids "double-counting" of energy savings.

Table H-12 Lighting Controls Retrofit LC-2: Ceiling Mounted Ultrasonic Motion Sensors

Building Number	Building Name	Room No / Name	ECO Included	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Sensor Savings (%)	Number of Sensors	Use Saved (KWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	13	-	8	R	F40T12	40	2	86	3	0.6	96	35%	1	270	$11.83	$0.00	$11.83	$142	$399	0.36	33.68
117-1	Services & Support	15	-	8	R	F40T12	40	2	86	3	0.6	96	35%	1	270	$11.83	$0.00	$11.83	$142	$399	0.36	33.68
117-1	Services & Support	16	-	1	R	F40T12	40	2	86	1	0.8	96	25%	1	86	$3.76	$0.00	$3.76	$45	$399	0.11	106.10
117-1	Services & Support	17	-	8	R	F40T12	40	2	86	1	0.6	96	35%	1	90	$3.94	$0.00	$3.94	$47	$399	0.12	101.05
117-3	Decontam & Small Parts	Men's W/C	LF-4B	8	S	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-3	Decontam & Small Parts	Women's W/C	LF-4B	8	S	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-4	Bulk Explosives Disposal	UG Toilet - Women	LF-4B	8	S	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-4	Bulk Explosives Disposal	UG Toilet - Men	LF-4B	8	S	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-5	Refining Building	Toilet - Mens'	-	8	S	F40T12	40	2	86	3	0.6	96	35%	1	270	$11.83	$0.00	$11.83	$142	$399	0.36	33.68
117-5	Refining Building	Toilet - Womens'	-	8	S	F40T12	40	2	86	2	0.6	96	35%	1	180	$7.89	$0.00	$7.89	$95	$399	0.24	50.52
117-6	Steamout Building	Toilet - Mens'	LD-2	8	S	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-6	Steamout Building	Toilet - Womens'	LD-2	8	S	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-6	Steamout Building	Lab	LF-4B	18	R	F32T8	32	2	61	7	0.7	96	35%	1	522	$22.85	$0.00	$22.85	$275	$399	0.69	17.44
117-8	Mech. Removal Building	Men's W/C	LD-2	8	S	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-8	Mech. Removal Building	Women's W/C	LD-2	8	S	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-10	Preparation Building	Women's W/C	LD-2	8	R	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
117-10	Preparation Building	Men's W/C	LD-2	8	R	F32T8	32	2	61	2	0.6	96	35%	1	128	$5.60	$0.00	$5.60	$67	$399	0.17	71.23
Totals for ECO LC-2														17	2,969	$130	$0.00	$129.90	$1,561	$6,776	0.23	52.16

Controls for toilet and bathrooms and other spaces with partitions or other sight-line-obscuring features must be able to "see" over and around them. Ultrasonic motion sensors provide this service.
Savings are assumed to be at the lower end, or below, savings ranges claimed by manufacturers of motion sensor controls, based on performance of actual installed systems.
Delamping and fixture retrofit ECOs with SIRs above 1.0 are assumed implemented prior to evaluation of energy savings for lighting control retrofit ECOs. This avoids "double-counting" of energy savings.

Table H-13 Lighting Controls Retrofit LC-3: Passive Infrared (PIR) Motion Sensor / Wall Switches

Building Number	Building Name	Room No / Name	ECO Included	Task Code	Type Code	Lamp Type	Watts/ Lamp	Lamp/ Fixture	Watts/ Fixture	No of Fixtures	Demand Factor	Fixture (Hr/Wk)	Sensor Savings (%)	Number of Sensors	Use Saved (KWH/Yr)	Energy ($/Yr)	O&M Saved ($/Yr)	Total Saved ($/Yr)	Total LCC$ Saved	Invest-ment ($)	SIR	Payback (Years)
117-1	Services & Support	1	LD-2	4	R	F32T8	32	2	61	4	0.7	96	30%	1	256	$11.19	$0.00	$11.19	$135	$119	1.13	10.67
117-1	Services & Support	6	-	18	R	F40T12	40	2	86	4	1.0	96	30%	1	515	$22.54	$0.00	$22.54	$271	$119	2.27	5.30
117-1	Services & Support	7	-	18	R	F40T12	40	2	86	12	1.0	96	30%	1	1,546	$67.62	$0.00	$67.62	$813	$119	6.81	1.77
117-1	Services & Support	18	LF-4B	4	R	F32T8	32	2	61	2	0.7	96	30%	1	128	$5.60	$0.00	$5.60	$67	$119	0.56	21.34
117-1	Services & Support	19	LF-4B	4	R	F32T8	32	2	61	2	0.7	96	30%	1	128	$5.60	$0.00	$5.60	$67	$119	0.56	21.34
117-1	Services & Support	28	-	1	R	F40T12	40	2	86	1	0.8	96	25%	1	86	$3.76	$0.00	$3.76	$45	$119	0.38	31.78
117-1	Services & Support	28	-	12	R	F40T12	40	2	86	1	0.7	96	40%	1	120	$5.26	$0.00	$5.26	$63	$119	0.53	22.70
117-1	Services & Support	33	-	12	S	F40T12	40	2	86	4	0.7	96	40%	1	481	$21.04	$0.00	$21.04	$253	$119	2.12	5.68
117-1	Services & Support	34	-	12	S	F40T12	40	2	86	2	0.7	96	40%	1	240	$10.52	$0.00	$10.52	$126	$119	1.06	11.35
117-1	Services & Support	35	-	12	S	F40T12	40	2	86	2	0.7	96	40%	1	240	$10.52	$0.00	$10.52	$126	$119	1.06	11.35
117-1	Services & Support	36	-	12	S	F40T12	40	2	86	4	0.7	96	40%	1	481	$21.04	$0.00	$21.04	$253	$119	2.12	5.68
117-1	Services & Support	2&3	-	18	S	F40T12	40	2	86	2	1.0	96	30%	2	258	$11.27	$0.00	$11.27	$135	$239	0.57	21.19
117-3	Decontam & Small Parts	Women's Lounge	LD-2	8	S	F32T8	32	2	61	1	0.6	96	35%	1	64	$2.80	$0.00	$2.80	$34	$119	0.28	42.68
117-4	Bulk Explosives Disposal	Women's Lounge	LD-2	8	S	F32T8	32	2	61	1	0.6	96	35%	1	64	$2.80	$0.00	$2.80	$34	$119	0.28	42.68
117-5	Refining Building	Lounge - Women's	-	8	S	F40T12	40	2	86	1	0.6	96	35%	1	90	$3.94	$0.00	$3.94	$47	$119	0.40	30.27
117-6	Steamout Building	Womens' Lounge	LD-2	8	S	F32T8	32	2	61	1	0.6	96	35%	1	64	$2.80	$0.00	$2.80	$34	$119	0.28	42.68
117-8	Mech. Removal Building	Women's Lounge	LD-2	8	S	F32T8	32	2	61	1	0.6	96	35%	1	64	$2.80	$0.00	$2.80	$34	$119	0.28	42.68
117-10	Preparation Building	Women's Lounge	LD-2	8	R	F32T8	32	2	61	1	0.6	96	35%	1	64	$2.80	$0.00	$2.80	$34	$119	0.28	42.68
Totals for ECO LC-3														19	4,888	$214	$0.00	$213.88	$2,571	$2,269	1.13	10.61

Wall mounted PIR motion sensors replace existing wall toggle switches in small offices and other spaces.
Savings are assumed to be at the lower end, or below, savings ranges claimed by manufacturers of motion sensor controls, based on performance of actual installed systems.
Delamping and fixture retrofit ECOs with SIRs above 1.0 are assumed implemented prior to evaluation of energy savings for lighting control retrofit ECOs. This avoids "double-counting" of energy savings.

Table H-14. Energy Use and Operating Costs of Existing Lighting Fixtures

Existing Fixture Type Description	Watts per Fixture	Lamp Life (Hours)	Lamp Cost ($ Each)	Labor (Hr/Lamp)	Cost/1,000 Lamp-Hrs	Proposed Lighting Fixture Retrofits
Lighting Fixture Delamping with Lamp and Ballast Retrofits						
F40T12 - 2 Lamps per Fixture - Standard Fixture	86.0	20,000	$2.75	0.150	$0.363	LD-1: Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0	20,000	$2.75	0.122	$0.321	LD-2: Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast
Lighting Fixture Lamp and/or Ballast Retrofits						
Exit Light: F-6W - 2 Lamps per Fixture	20.0	131,400	$2.45	0.083	$0.038	LF-1: Retrofit LED Lamp Kit in Existing Exit Lights
F40T12 - 1 Lamp per Fixture - Standard Fixture	50.0	20,000	$2.75	0.167	$0.388	LF-2: Retrofit Electronic Ballast & 1xF32T8 Lamp
F40T12 - 2 Lamps per Fixture - Standard Fixture	86.0	20,000	$2.75	0.150	$0.363	LF-3A: Retrofit Electronic Ballast & 2xF32T8 Lamps, Standard Fixture
F40T12 - 2 Lamps per Fixture - Industrial Fixture	86.0	20,000	$2.75	0.100	$0.288	LF-3B: Retrofit Electronic Ballast & 2xF32T8 Lamps, Industrial Fixture
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0	20,000	$2.75	0.122	$0.321	LF-4A: Retrofit Electronic Ballast & 4xF32T8 Lamps, or
F40T12 - 4 Lamps per Fixture - Standard Fixture	172.0	20,000	$2.75	0.122	$0.321	LF-4B: Delamping & Reflector + Electronic Ballast and 2xF32T8 Lamps
F48T12VH - 2 Lamps per Fixture - Explosion Proof Fixture	250.0	12,000	$16.31	0.375	$2.297	None: Required illumination cannot be achieved with the same number of any other type lamp using less energy, even with an addition of a specular reflector.
I-100W - 1 Lamp per Fixture - Ceiling & Wall Mounted	100.0	750	$0.51	0.083	$4.000	LF-5: Replace lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent
I-150W - 1 Lamp per Fixture - Ceiling & Wall Mounted	150.0	750	$0.51	0.083	$4.000	LF-6: Replace lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent
MV 175W - Pendant-Mount	198.0	24,000	$14.10	0.300	$0.963	LF-7: Retrofit with 50W HPS Lamp & Ballast
MH 400W - Pendant-Mount	460.0	20,000	$34.05	0.300	$2.153	LF-8: Retrofit with 250W HPS Lamp & Ballast

"Standard Fixtures" are either recessed or surface mounted, including lens.

Lamp replacement labor costs are based on a rate of $20 per hour plus 50% for burden and overhead. The labor rate is, thus, $30 per hour.

Table H-15. Energy Use and Operating Costs of Proposed Lighting Fixture Retrofits

Proposed Lighting Fixture (LF) Retrofits	Watts per Fixture	Lamp Life (Hours)	Lamp Cost ($ Each)	Labor (Hr/Lamp)	Cost/1,000 Lamp-Hrs
Lighting Fixture Delamping with Lamp and Ballast Retrofits					
LD-1: Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast	31.0	20,000	$2.83	0.150	$0.380
LD-2: Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast	61.0	20,000	$2.83	0.122	$0.335
Lighting Fixture Lamp and/or Ballast Retrofits					
LF-1: Retrofit LED Lamp Kit in Existing Exit Lights	1.8	220,000	$31.50	0.083	$0.155
LF-2: Retrofit Electronic Ballast & 1xF32T8 Lamp	31.0	20,000	$2.83	0.167	$0.407
LF-3A: Retrofit Electronic Ballast & 2xF32T8 Lamps, Standard Fixture	61.0	20,000	$2.83	0.150	$0.380
LF-3B: Retrofit Electronic Ballast & 2xF32T8 Lamps, Industrial Fixture	61.0	20,000	$2.83	0.100	$0.301
LF-4A: Retrofit Electronic Ballast & 4xF32T8 Lamps, or	122.0	20,000	$2.83	0.122	$0.335
LF-4B: Delamping & Reflector + Electronic Ballast and 2xF32T8 Lamps	61.0	20,000	$2.83	0.122	$0.335
LF-5: Replace lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent	35.0	10,000	$7.23	0.083	$0.987
LF-6: Replace lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent	35.0	10,000	$7.23	0.083	$0.987
LF-7: Retrofit with 50W HPS Lamp & Ballast	80.0	24,000	$23.95	0.300	$1.395
LF-8: Retrofit with 250W HPS Lamp & Ballast	300.0	24,000	$27.40	0.300	$1.539

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: Total Successful Lighting Fixture Retrofits & Control Projects		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$67,303		
B. SIOH	$4,038		
C. Design Cost	$4,038		
D. Total Cost (1A+1B+1C)	$75,380		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$75,380

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	768.43		$9,851	12.02	$118,409
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	50.49	kW	$5,161	12.02	$62,031
F. Total	($/kW-Year)	768.43		$15,012		$180,440

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$468.03		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$5,588

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$5,588	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$15,480	
5. Simple Payback (1G/4):	4.87	Years
6. Total Net Discounted Savings (2F5+3C):	$186,029	
7. Savings to Investment Ratio (SIR) (6/1G):	2.47	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LD-1:** Delamp and Retrofit from 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$270		
B. SIOH	$16		
C. Design Cost	$16		
D. Total Cost (1A+1B+1C)	$302		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$302

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	3.00		$38	12.02	$462
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	0.22	kW	$22	12.02	$270
F. Total	($/kW-Year)	3.00		$61		$732

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$6.89		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$82

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$82	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$68	
5. Simple Payback (1G/4):	4.46	Years
6. Total Net Discounted Savings (2F5+3C):	$815	
7. Savings to Investment Ratio (SIR) (6/1G):	2.69	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LD-2:** Delamp and Retrofit from 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$4,704		
B. SIOH	$282		
C. Design Cost	$282		
D. Total Cost (1A+1B+1C)	$5,268		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$5,268

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	75.46	$967	12.02	$11,627
B. Dist	$13.25	0	$0	14.23	$0
C. LPG					
D. Other					
E. Demand Saved	$102.21	6.33 kW	$647	12.02	$7,773
F. Total	($/kW-Year)	75.46	$1,614		$19,400

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$196.34		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$2,344

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$2,344	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$1,810	
5. Simple Payback (1G/4):	2.91	Years
6. Total Net Discounted Savings (2F5+3C):	$21,745	
7. Savings to Investment Ratio (SIR) (6/1G):	4.13	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-1:** Retrofit LED Lamp Kit in Existing Exit Lights		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$5,390		
B. SIOH	$323		
C. Design Cost	$323		
D. Total Cost (1A+1B+1C)	$6,037		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$6,037

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	43.95		$563	12.02	$6,773
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	1.47	kW	$151	12.02	$1,811
F. Total	($/kW-Year)	43.95		$714		$8,584

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($56.60)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($676)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($676)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$658	
5. Simple Payback (1G/4):	9.18	Years
6. Total Net Discounted Savings (2F5+3C):	$7,908	
7. Savings to Investment Ratio (SIR) (6/1G):	1.31	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-2:** Retrofit Electronic Ballast & 1xF32T8 Lamp in Existing 1-Lamp F40T12 Fixtures		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$1,599		
B. SIOH	$96		
C. Design Cost	$96		
D. Total Cost (1A+1B+1C)	$1,791		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$1,791

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	2.93		$38	12.02	$451
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	0.49	kW	$50	12.02	$607
F. Total	($/kW-Year)	2.93		$88		$1,058

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($1.12)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($13)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($13)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$87	
5. Simple Payback (1G/4):	20.60	Years
6. Total Net Discounted Savings (2F5+3C):	$1,045	
7. Savings to Investment Ratio (SIR) (6/1G):	0.58	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-3A:** Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Standard 2-Lamp F40T12 Fixtures		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$13,521		
B. SIOH	$811		
C. Design Cost	$811		
D. Total Cost (1A+1B+1C)	$15,144		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$15,144

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	63.45		$813	12.02	$9,778
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	4.68	kW	$478	12.02	$5,743
F. Total	($/kW-Year)	63.45		$1,291		$15,521

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($32.48)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($388)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($388)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$1,259	
5. Simple Payback (1G/4):	12.03	Years
6. Total Net Discounted Savings (2F5+3C):	$15,133	
7. Savings to Investment Ratio (SIR) (6/1G):	1.00	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-3B:** Retrofit Electronic Ballast & 2xF32T8 Lamps in Existing Industrial 2-Lamp F40T12 Fixtures		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$22,297		
B. SIOH	$1,338		
C. Design Cost	$1,338		
D. Total Cost (1A+1B+1C)	$24,973		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$24,973

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	74.71		$958	12.02	$11,512
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	8.10	kW	$828	12.02	$9,951
F. Total	($/kW-Year)	74.71		$1,786		$21,463

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($28.94)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($346)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($346)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$1,757	
5. Simple Payback (1G/4):	14.22	Years
6. Total Net Discounted Savings (2F5+3C):	$21,118	
7. Savings to Investment Ratio (SIR) (6/1G):	0.85	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-4A:** Retrofit Electronic Ballast & 4 x F32T8 Lamps in Existing 4-Lamp F40T12 Fixtures, or		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$16,241		
B. SIOH	$974		
C. Design Cost	$974		
D. Total Cost (1A+1B+1C)	$18,190		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$18,190

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	83.44		$1,070	12.02	$12,858
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	5.90	kW	$603	12.02	$7,248
F. Total	($/kW-Year)	83.44		$1,673		$20,106

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($36.42)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($435)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($435)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$1,636	
5. Simple Payback (1G/4):	11.12	Years
6. Total Net Discounted Savings (2F5+3C):	$19,671	
7. Savings to Investment Ratio (SIR) (6/1G):	1.08	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-4B:** Delamp to 2xF32T8 Lamps & Install Reflector & Electronic Ballast in 4-Lamp F40T12 Fixtures		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$8,862		
B. SIOH	$532		
C. Design Cost	$532		
D. Total Cost (1A+1B+1C)	$9,925		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$9,925

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	185.24		$2,375	12.02	$28,544
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	13.10	kW	$1,339	12.02	$16,091
F. Total	($/kW-Year)	185.24		$3,713		$44,635

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$371.38		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$4,434

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$4,434	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$4,085	
5. Simple Payback (1G/4):	2.43	Years
6. Total Net Discounted Savings (2F5+3C):	$49,069	
7. Savings to Investment Ratio (SIR) (6/1G):	4.94	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-5:** Replace 100W Incandescent lamp and base with DTT-26W, 2700K, CRI 82 Compact Fluorescent & Ballast		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$276		
B. SIOH	$17		
C. Design Cost	$17		
D. Total Cost (1A+1B+1C)	$309		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$309

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	4.66		$60	12.02	$718
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	0.39	kW	$40	12.02	$479
F. Total	($/kW-Year)	4.66		$100		$1,197

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$63.30		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$756

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$756	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$163	
5. Simple Payback (1G/4):	1.90	Years
6. Total Net Discounted Savings (2F5+3C):	$1,953	
7. Savings to Investment Ratio (SIR) (6/1G):	6.33	

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Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-6:** Replace 150W Incandescent lamp and base with DTT-26W, 2700K, CRI 80 Compact Fluorescent & Ballast		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$138		
B. SIOH	$8		
C. Design Cost	$8		
D. Total Cost (1A+1B+1C)	$154		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$154

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	0.73		$9	12.02	$113
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	0.35	kW	$35	12.02	$424
F. Total	($/kW-Year)	0.73		$45		$537

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$5.64		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$67

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$67	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$50	
5. Simple Payback (1G/4):	3.07	Years
6. Total Net Discounted Savings (2F5+3C):	$604	
7. Savings to Investment Ratio (SIR) (6/1G):	3.91	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-7:** Retrofit Existing 175W MV Exterior Light Fixtures with 50W HPS Lamps & Ballasts		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$22,314		
B. SIOH	$1,339		
C. Design Cost	$1,339		
D. Total Cost (1A+1B+1C)	$24,991		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$24,991

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	242.76		$3,112	12.02	$37,407
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	16.28	kW	$1,664	12.02	$20,005
F. Total	($/kW-Year)	242.76		$4,776		$57,413

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($260.96)		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			($3,116)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	($3,116)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$4,515	
5. Simple Payback (1G/4):	5.53	Years
6. Total Net Discounted Savings (2F5+3C):	$54,297	
7. Savings to Investment Ratio (SIR) (6/1G):	2.17	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LF-8:** Retrofit Existing 400W Metal Halide Explosion Proof Fixtures with 250W HPS Lamps & Ballasts		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$9,804		
B. SIOH	$588		
C. Design Cost	$588		
D. Total Cost (1A+1B+1C)	$10,980		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$10,980

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	132.49		$1,698	12.02	$20,415
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	7.68	kW	$785	12.02	$9,435
F. Total	($/kW-Year)	132.49		$2,483		$29,850

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$174.52		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$2,084

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$2,084	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$2,658	
5. Simple Payback (1G/4):	4.13	Years
6. Total Net Discounted Savings (2F5+3C):	$31,934	
7. Savings to Investment Ratio (SIR) (6/1G):	2.91	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: **ECO LC-1:** Lighting Control Retrofit: Install Ceiling Mounted Passive Infrared (PIR) Motion Sensors		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$8,541		
B. SIOH	$512		
C. Design Cost	$512		
D. Total Cost (1A+1B+1C)	$9,566		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$9,566

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	33.16		$425	12.02	$5,109
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	0.00	kW	$0	12.02	$0
F. Total	($/kW-Year)	33.16		$425		$5,109

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0.00		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$0	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$425	
5. Simple Payback (1G/4):	22.51	Years
6. Total Net Discounted Savings (2F5+3C):	$5,109	
7. Savings to Investment Ratio (SIR) (6/1G):	0.53	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.
Project Title:	ECIP Facility Energy Improvements: ECO LC-2: Lighting Control Retrofit: Install Ceiling Mounted Ultrasonic Motion Sensors		Fiscal Year FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$6,050		
B. SIOH	$363		
C. Design Cost	$363		
D. Total Cost (1A+1B+1C)	$6,776		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$6,776

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	10.13		$130	12.02	$1,561
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	0.00	kW	$0	0.00	$0
F. Total	($/kW-Year)	10.13		$130		$1,561

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0.00		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$0	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$130	
5. Simple Payback (1G/4):	52.16	Years
6. Total Net Discounted Savings (2F5+3C):	$1,561	
7. Savings to Investment Ratio (SIR) (6/1G):	0.23	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant, Western Area Demilitarization Facility	Region No. 4	Project No.	
Project Title:	ECIP Facility Energy Improvements: **ECO LC-3:** Lighting Control Retrofit: Replace Wall-Switches with Passive Infrared (PIR) Motion Sensor Switches		Fiscal Year	FY97
Analysis Date:	November 1994	Economic Life: 15 Years	Preparer:	KELLER & GANNON

1. Investment Costs

A. Construction Costs	$2,026		
B. SIOH	$122		
C. Design Cost	$122		
D. Total Cost (1A+1B+1C)	$2,269		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$2,269

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	16.68		$214	12.02	$2,571
B. Dist	$13.25	0		$0	14.23	$0
C. LPG						
D. Other						
E. Demand Saved	$102.21	0.00	kW	$0	14.23	$0
F. Total	($/kW-Year)	16.68		$214		$2,571

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0.00		
(1) Discount Factor (Table A)		11.94	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+)Cost(-)(4)
a.				
b.				
c.				
d. Total				

C Total Non Energy Discounted Savings (3A2+3Bd4)	$0	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Economic Life)):	$214	
5. Simple Payback (1G/4):	10.61	Years
6. Total Net Discounted Savings (2F5+3C):	$2,571	
7. Savings to Investment Ratio (SIR) (6/1G):	1.13	

CONSTRUCTION COST ESTIMATE	Date Prepared: Nov-94	Sheet 1 of 7
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate: Code A (no design competed)
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada		
Engineer-Architect: Keller & Gannon		
Drawing No.: **Lighting ECO Unit Costs**	Estimator: **BIH**	Checked By: **RCL**

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
LD-1. Delamp & Retrofit:	**From 2-Lamp F40T12 Fixture to a 1-Lamp F32T8 Fixture with Electronic Ballast**						
Remove 1 F40T12 Lamp & Pin Connectors	1	EA	$2.50	$2.50	$0.00	$0.00	$2.50
Electronic Ballast: 6250-01-353-7722	1	EA	$12.50	$12.50	$25.00	$25.00	$37.50
F32T8 Lamp: 6240-01-344-9943 or 9508	1	EA	$4.50	$4.50	$2.83	$2.83	$7.33
Subtotal				$19.50		$27.83	$47.33
Nevada Sales Tax	3.75%	%		-		$1.04	$1.04
Subtotal							$48.37
Contractor OH & Profit	25.0%	%					$12.09
Subtotal							$60.47
Bond	1.5%	%					$0.91
Subtotal							$61.37
Estimating Contingency	10.0%	%					$6.14
Total Probable Construction Cost							**$67.51**
LD-2. Delamp & Retrofit:	**From 4-Lamp F40T12 Fixture to a 2-Lamp F32T8 Fixture with Electronic Ballast**						
Remove 1 F40T12 Lamp & Pin Connectors	2	EA	$2.50	$5.00	$0.00	$0.00	$5.00
Electronic Ballast: 6250-01-379-3041	1	EA	$15.00	$15.00	$25.00	$25.00	$40.00
F32T8 Lamp: 6240-01-344-9943 or 9508	2	EA	$3.66	$7.32	$2.83	$5.66	$12.98
Subtotal				$27.32		$30.66	$57.98
Nevada Sales Tax	3.75%	%		-		$1.15	$1.15
Subtotal							$59.13
Contractor OH & Profit	25.0%	%					$14.78
Subtotal							$73.91
Bond	1.5%	%					$1.11
Subtotal							$75.02
Estimating Contingency	10.0%	%					$7.50
Total Probable Construction Cost							**$82.52**

Note: Labor costs are based on a subcontractor rate of $30/hour including burden for electricians.

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CONSTRUCTION COST ESTIMATE				Date Prepared Nov-94		Sheet 2 of 7	
Project: ECIP Facility Energy Improvements				Project No.	Basis for Estimate: Code A (no design competed)		
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada							
Engineer-Architect: Keller & Gannon							
Drawing No.: Lighting ECO Unit Costs		Estimator: BIH			Checked By: RCL		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
LF-1. Exit Light LED Retrofit							
LED Kit: 277V, 6240-01-381-2061	1	EA	$15.00	$15.00	$31.50	$31.50	$46.50
Nevada Sales Tax	3.75%	%		-		$1.18	$1.18
Subtotal							$47.68
Contractor OH & Profit	25.0%	%					$11.92
Subtotal							$59.60
Bond	1.5%	%					$0.89
Subtotal							$60.50
Estimating Contingency	10.0%	%					$6.05
Total Probable Construction Cost							**$66.55**
LF-2. F40T12, 1 Lamp Fixtures:	**Replace Lamps with F32T8 Lamps and Retrofit an Electronic Ballast**						
Electronic Ballast: 277V=6250-01-379-3041	1	EA	$12.50	$12.50	$25.00	$25.00	$37.50
F32T8 Lamp: 6240-01-344-9943 or 9508	1	EA	$2.70	$2.70	$2.83	$2.83	$5.53
Subtotal				$15.20		$27.83	$43.03
Nevada Sales Tax	3.75%	%		-		$1.04	$1.04
Subtotal							$44.07
Contractor OH & Profit	25.0%	%					$11.02
Subtotal							$55.09
Bond	1.5%	%					$0.83
Subtotal							$55.92
Estimating Contingency	10.0%	%					$5.59
Total Probable Construction Cost							**$61.51**
LF-3A. F40T12, 2 Lamp Fixtures: (Standard Fixtures)	**Replace Lamps with F32T8 Lamps and Retrofit an Electronic Ballast**						
Electronic Ballast: 277V, 6250-01-379-3041	1	EA	$15.00	$15.00	$25.00	$25.00	$40.00
F32T8 Lamp: 6240-01-344-9943 or 9508	2	EA	$2.50	$5.00	$2.83	$5.66	$10.66
Subtotal				$20.00		$30.66	$50.66
Nevada Sales Tax	3.75%	%		-		$1.15	$1.15
Subtotal							$51.81
Contractor OH & Profit	25.0%	%					$12.95
Subtotal							$64.76
Bond	1.5%	%					$0.97
Subtotal							$65.73
Estimating Contingency	10.0%	%					$6.57
Total Probable Construction Cost							**$72.31**

Note: Labor costs are based on a subcontractor rate of $30/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE	Date Prepared Nov-94	Sheet 3 of 7
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate: Code A (no design competed)
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada		
Engineer-Architect: Keller & Gannon		
Drawing No.: Lighting ECO Unit Costs	Estimator: BIH	Checked By: RCL

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
LF-3B. F40T12, 2 Lamp Fixtures: (Industrial Fixtures)	**Replace Lamps with F32T8 Lamps and Retrofit an Electronic Ballast**						
Electronic Ballast:120V=6250-01-379-1917; or Electronic Ballast:277V=6250-01-379-3041	1	EA	$13.00	$13.00	$25.00	$25.00	$38.00
F32T8 Lamp: 6240-01-344-9943 or 9508	2	EA	$2.25	$4.50	$2.83	$5.66	$10.16
Subtotal				$17.50		$30.66	$48.16
Nevada Sales Tax	3.75%	%		-		$1.15	$1.15
Subtotal							$49.31
Contractor OH & Profit	25.0%	%					$12.33
Subtotal							$61.64
Bond	1.5%	%					$0.92
Subtotal							$62.56
Estimating Contingency	10.0%	%					$6.26
Total Probable Construction Cost							**$68.82**
LF-4A. F40T12, 4 Lamp Fixtures:	**Replace Lamps with F32T8 Lamps and Retrofit Electronic Ballasts**						
Electronic Ballast:120V=6250-01-379-1917; or Electronic Ballast: 277V=6250-01-379-3041	2	EA	$13.00	$26.00	$25.00	$50.00	$76.00
F32T8 Lamp: 6240-01-344-9943 or 9508	4	EA	$2.25	$9.00	$2.83	$11.32	$20.32
Subtotal				$35.00		$61.32	$96.32
Nevada Sales Tax	3.75%	%		-		$2.30	$2.30
Subtotal							$98.62
Contractor OH & Profit	25.0%	%					$24.65
Subtotal							$123.27
Bond	1.5%	%					$1.85
Subtotal							$125.12
Estimating Contingency	10.0%	%					$12.51
Total Probable Construction Cost							**$137.64**

Note: Labor costs are based on a subcontractor rate of $30/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: Nov-94	Sheet 4	of 7
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate: Code A (no design competed)	
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada			
Engineer-Architect: Keller & Gannon			
Drawing No.: Lighting ECO Unit Costs	Estimator: BIH	Checked By: RCL	

each location one.

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
LF-4B. F40T12, 4 Lamp Fixtures:	**Retrofit Reflector, Delamp to 3 each F32T8 Lamps and an Electronic Ballast** 2						
Electronic Ballast:120V=6250-01-364-2997; or 277V=6250-01-364-2998	1	EA	$17.50	$17.50	$36.44	$36.44	$53.94
F32T8 Lamp: 6240-01-344-9943 or 9508	2 3	EA	$2.25	$6.75	$2.83	$8.49	$15.24
Reflector Retrofit for Delamping: R302-348T8 SSB 2'x4' for 3xF32T8	1	EA	$6.00	$6.00	$49.00	$49.00	$55.00
Subtotal				$24.25		$44.93	$69.18
Nevada Sales Tax	3.75%	%		-		$1.68	$1.68
Subtotal							$70.86
Contractor OH & Profit	25.0%	%					$17.71
Subtotal							$88.57
Bond	1.5%	%					$1.33
Subtotal							$89.90
Estimating Contingency	10.0%	%					$8.99
Total Probable Construction Cost							**$98.89**
LF-5. 100W Incandescent Fixture:	**Replace Fixture with DTT 26W Compact Fluorescent Lamp, Base and Ballast**						
Remove Existing Incandescent Fixture	1	EA	$7.50	$7.50	$0.00	$0.00	$7.50
Advance (or Equal) L-1Q26TP Ballast	1	EA	$6.00	$6.00	$0.89	$0.89	$6.89
Adaptor Base: 26 Watt, G240-3, 6250-01-352-1529	1	EA	$2.50	$2.50	$5.79	$5.79	$8.29
DTT 26W, 2700K CRI 82 Compact Fluorescent Lamp: 6240-01-345-9535	1	EA	$2.50	$2.50	$7.23	$7.23	$9.73
Subtotal				$18.50		$13.90	$32.40
Nevada Sales Tax	3.75%	%		-		$0.52	$0.52
Subtotal							$32.92
Contractor OH & Profit	25.0%	%					$8.23
Subtotal							$41.15
Bond	1.5%	%					$0.62
Subtotal							$41.77
Estimating Contingency	10.0%	%					$4.18
Total Probable Construction Cost							**$45.95**

Note: Labor costs are based on a subcontractor rate of $30/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE	Date Prepared Nov-94	Sheet 5 of 7
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate: Code A (no design competed)
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada		
Engineer-Architect: Keller & Gannon		
Drawing No.: **Lighting ECO Unit Costs**	Estimator: **BIH**	Checked By: **RCL**

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
LF-6. 150W Incandescent Fixture:	**Replace Fixture with DTT 26W Compact Fluorescent Lamp, Base and Ballast**						
Remove Existing Incandescent Fixture	1	EA	$7.50	$7.50	$0.00	$0.00	$7.50
Advance (or Equal) L-1Q26TP Ballast	1	EA	$6.00	$6.00	$0.89	$0.89	$6.89
Adaptor Base: 26 Watt, G240-3, 6250-01-352-1529	1	EA	$2.50	$2.50	$5.79	$5.79	$8.29
DTT 26W, 2700K CRI 82 Compact Fluorescent Lamp: 6240-01-345-9535	1	EA	$2.50	$2.50	$7.23	$7.23	$9.73
Subtotal				$18.50		$13.90	$32.40
Nevada Sales Tax	3.75%	%		-		$0.52	$0.52
Subtotal							$32.92
Contractor OH & Profit	25.0%	%					$8.23
Subtotal							$41.15
Bond	1.5%	%					$0.62
Subtotal							$41.77
Estimating Contingency	10.0%	%					$4.18
Total Probable Construction Cost							**$45.95**
LF-7. 175W MV Fixture:	**Retrofit with 50 Watt High Pressure Sodium (HPS) Lamp and Ballast**						
Ballast, 50W S-68: 6250-01-348-6628	1	EA	$27.00	$27.00	$53.02	$53.02	$80.02
HPS Lamp 50W ANSI S-68 E-23 1/2 Coated: 6240-01-228-9595	1	EA	$9.00	$9.00	$23.95	$23.95	$32.95
Subtotal				$36.00		$76.97	$112.97
Nevada Sales Tax	3.75%	%		-		$2.89	$2.89
Subtotal							$115.86
Contractor OH & Profit	25.0%	%					$28.96
Subtotal							$144.82
Bond	1.5%	%					$2.17
Subtotal							$146.99
Estimating Contingency	10.0%	%					$14.70
Total Probable Construction Cost							**$161.69**

Note: Labor costs are based on a subcontractor rate of $30/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE					Date Prepared Nov-94		Sheet 6 of 7	
Project ECIP Facility Energy Improvements					Project No.	Basis for Estimate		
Location Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada						Code A (no design competed)		
Engineer-Architect Keller & Gannon								
Drawing No. **Lighting ECO Unit Costs**		Estimator **BIH**				Checked By **RCL**		

Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
LF-8. 400W MV Fixture: (Explosion Proof Fixtures)	**Retrofit with 250 Watt High Pressure Sodium (HPS) Lamp and Ballast**						
Ballast, 250W S-50: 6250-01-348-6629	1	EA	$27.60	$27.60	$78.38	$78.38	$105.98
HPS Lamp 250W ANSI S-50 E-28 Coated: 6240-01-094-8332	1	EA	$9.00	$9.00	$27.40	$27.40	$36.40
Subtotal				$36.60		$105.78	$142.38
Nevada Sales Tax	3.75%	%		-		$3.97	$3.97
Subtotal							$146.35
Contractor OH & Profit	25.0%	%					$36.59
Subtotal							$182.93
Bond	1.5%	%					$2.74
Subtotal							$185.68
Estimating Contingency	10.0%	%					$18.57
Total Probable Construction Cost							**$204.25**
LC-1. Occupancy Sensor Control:	**Ceiling Mounted Passive Infrared (PIR) Sensor** (conference rooms & large offices)						
Occupancy Sensor: PIR or Ultra Sonic	1	EA	$34.29	$34.29	$86.00	$86.00	$120.29
Sensor Transformer Pack	1	EA	$24.00	$24.00	$30.00	$30.00	$54.00
Wiremold Raceway & 3/C #18 Wire	25	LF	$2.38	$59.50	$0.65	$16.25	$75.75
Subtotal				$59.50		$132.25	$250.04
Nevada Sales Tax	3.75%	%		-		$4.96	$4.96
Subtotal							$255.00
Contractor OH & Profit	25.0%	%					$63.75
Subtotal							$318.75
Bond	1.5%	%					$4.78
Subtotal							$323.53
Estimating Contingency	10.0%	%					$32.35
Total Probable Construction Cost							**$355.88**

Note: Labor costs are based on a subcontractor rate of $30/hour including burden for electricians.

CONSTRUCTION COST ESTIMATE				Date Prepared Nov-94		Sheet 7 of 7	
Project: ECIP Facility Energy Improvements				Project No.		Basis for Estimate: Code A (no design competed)	
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada							
Engineer-Architect: Keller & Gannon							
Drawing No.: **Lighting ECO Unit Costs**			Estimator: **BIH**			Checked By: **RCL**	

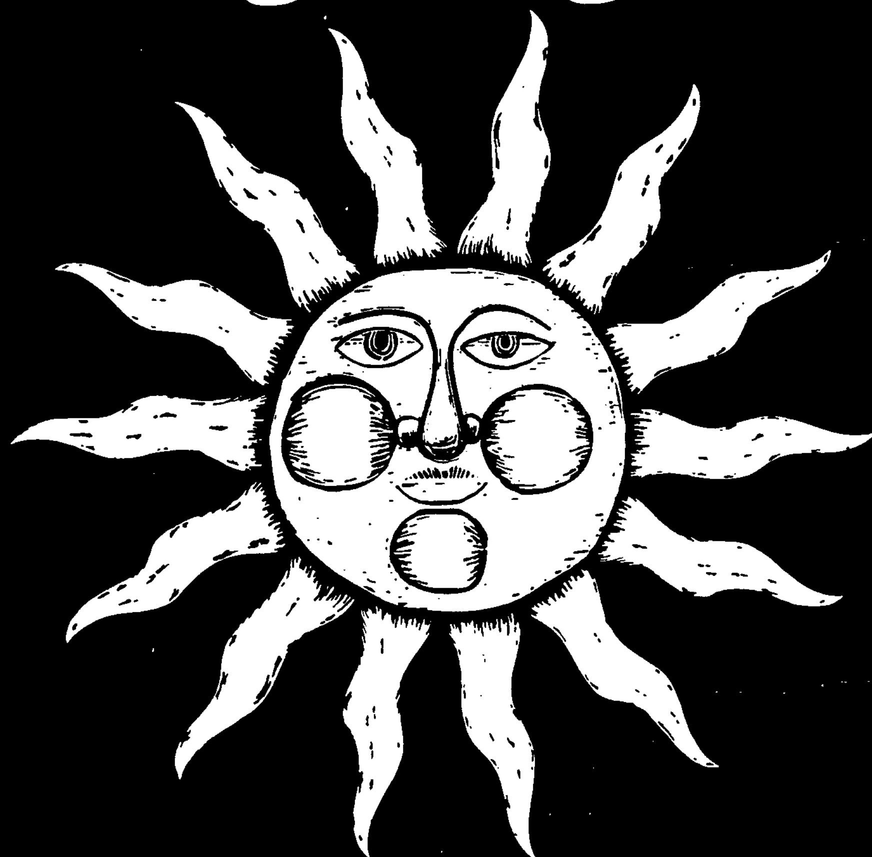
Line Item	Quantity		Labor		Material		Total Cost
	No. Units	Unit Meas.	Per Unit	Total	Per Unit	Total	
LC-2. Occupancy Sensor Control:	**Ceiling Mounted Ultra Sonic Sensor for use in Bathrooms and Toilets**						
Occupancy Sensor: PIR or Ultra Sonic	1	EA	$34.29	$34.29	$86.00	$86.00	$120.29
Sensor Transformer Pack	1	EA	$24.00	$24.00	$30.00	$30.00	$54.00
Wiremold Raceway & 3/C #18 Wire	25	LF	$2.38	$59.50	$0.65	$16.25	$75.75
Subtotal				$59.50		$132.25	$250.04
Nevada Sales Tax	3.75%	%		-		$4.96	$4.96
Subtotal							$255.00
Contractor OH & Profit	25.0%	%					$63.75
Subtotal							$318.75
Bond	1.5%	%					$4.78
Subtotal							$323.53
Estimating Contingency	10.0%	%					$32.35
Total Probable Construction Cost							**$355.88**
LC-3. Occupancy Sensor Control:	**Automatic Wall Switch Passive Infrared (PIR) Sensor for Smaller Office Areas**						
Occupancy Sensor: PIR or Ultra Sonic	1	EA	$9.99	$9.99	$64.00	$64.00	$73.99
Subtotal				$9.99		$64.00	$73.99
Nevada Sales Tax	3.75%	%		-		$2.40	$2.40
Subtotal							$76.39
Contractor OH & Profit	25.0%	%					$19.10
Subtotal							$95.49
Bond	1.5%	%					$1.43
Subtotal							$96.92
Estimating Contingency	10.0%	%					$9.69
Total Probable Construction Cost							**$106.61**

Note: Labor costs are based on a subcontractor rate of $30/hour including burden for electricians.

DGSC
The Supplier
of Choice

Energy Efficient Lighting

"Invest in the Environment. The Dividends Will Last a Lifetime."



DEFENSE GENERAL SUPPLY CENTER
Richmond, Virginia

1-800-DLA BULB

FEBRUARY 1994

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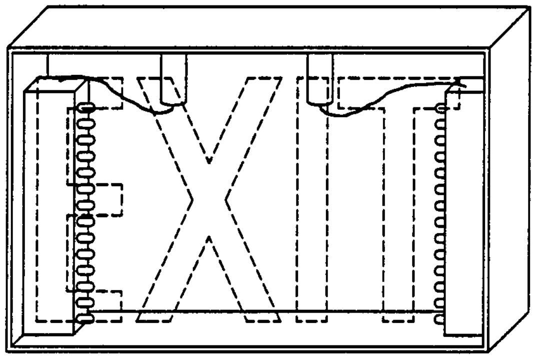
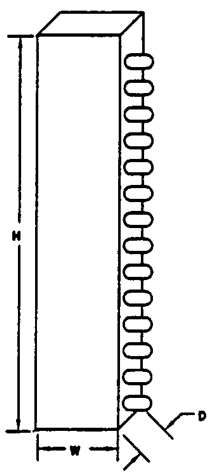
We appreciate your business!

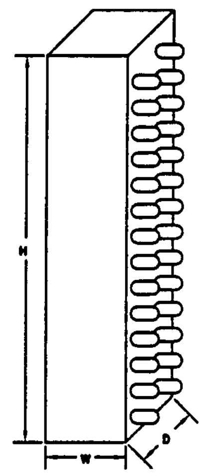
DEFENSE GENERAL SUPPLY CENTER

LED Exit Sign Retrofit Kits

- **1.8 - 3.6 Input Watts/Fixture. (Replaces standard 20-25 watt lamps.)**
- Convert existing incandescent EXIT signs to use energy efficient LED light strips.
- Each kit contains two LED light strips and a reflective backing to provide even light distribution and a new red lens for the fixture.
- Estimated life is 25 years.
- Complies with OSHA and NFPA requirements.
- Available in four base styles to fit existing sockets or as a hard wire kit.
- LED light strips emit a bright red light and are not recommended for use with green signs.
- In addition to DGSC standard warranty, manufacturer's 25 year warranty applies.
- UL approved.







TOTAL WATTS	BASE	VOLTS	NATIONAL STOCK NUMBER
SINGLE FACE KITS			
DIM: 6" H X 7/8" W X 3/4" D , each strip.			
1.8	DC BAY	120	**6240-01-381-1658**
1.8	INTERMEDIATE	120	**6240-01-381-1702**
1.8	CANDELABRA	120	**6240-01-381-1843**
1.8	MEDIUM	120	**6240-01-381-1589**
1.8	HARD WIRE	120	**6240-01-381-1957**
1.8	HARD WIRE	277	**6240-01-381-2061**

Information provided by Computer Power Inc. Astralite Divison.

TOTAL WATTS	BASE	VOLTS	NATIONAL STOCK NUMBER
DOUBLE FACE KITS			
DIM: 6" H X 7/8" W X 1 1/2" D , each strip.			
3.6	DC BAY	120	**6240-01-381-1594**
3.6	INTERMEDIATE	120	**6240-01-381-1633**
3.6	CANDELABRA	120	**6240-01-381-1695**
3.6	MEDIUM	120	**6240-01-381-1552**
3.6	HARD WIRE	120	**6240-01-381-1818**
3.6	HARD WIRE	277	**6240-01-381-1940**

Fluorescent Lamps

MEDIUM BIPIN

U-TUBE LAMPS

SINGLE PIN

LAMP	BASE	WATTS	MOL INCHES	CHROMATICITY/CRI/DESCRIPTION	INITIAL LUMENS	AVG LIFE	NATIONAL STOCK NUMBER
PREHEAT							
F15T8							
T8	MED BIPIN	15	18	WARM WHITE, CRI 52	860	7500	6240-00-800-4668
				COOL WHITE, CRI 62	825	7500	6240-00-152-2982
F20T12							
T12	MED BIPIN	20	24	WARM WHITE, CRI 52	1250	9000	6240-00-299-7250
				COOL WHITE, CRI 62	1200	9000	6240-00-152-2996
F40CW/PH/ES (Energy Saving Replacement for F40CW/PH, 40W lamp)							
T12	MED BIPIN	34	48	COOL WHITE, CRI 62	2700	15000	6240-01-344-9524
T-8 LAMPS							
F25T8 AND F32T8 (Use With T-8 Electronic or Magnetic Ballasts)							
T8	MED BIPIN	25	36	3000K, CRI 80, (CG)	2250	20000	6240-01-364-6963
				3500K, CRI 80, (CG)	2250	20000	6240-01-364-6964
				4100K, CRI 80, (CG)	2250	20000	6240-01-364-6965
		32	48	3000K, CRI 70	2850	20000	6240-01-344-9535
				3500K, CRI 70	2850	20000	6240-01-344-9536
				4100K, CRI 70	2850	20000	6240-01-344-9537
				3000K, CRI 85, (CG)	3050	20000	6240-01-344-9943
				3500K, CRI 85, (CG)	3050	20000	6240-01-344-9508
				4100K, CRI 85, (CG)	3050	20000	6240-01-344-9507
T-9 LAMPS (USE WITH T-8 ELECTRONIC, T-8 MAGNETIC, OR T-12 ELECTRONIC BALLAST)							
T9	MED BIPIN	30/34	48	4200K, CRI 82, (CG)	2750*	24000	6240-01-367-0690
				5000K, CRI 85, (CG)	2750*	24000	6240-01-367-0691
				5500K, CRI 91, (CG)	2350*	24000	6240-01-367-0692
T-8 U-TUBES (Use With T-8 Electronic or Magnetic Ballast)							
T8	MED BIPIN	31	22.5	3100K, CRI 70, 1 5/8" LEG SPACING	2800	20000	6240-01-353-7706
				3500K, CRI 70, 1 5/8" LEG SPACING	2800	20000	6240-01-353-7707
				4100K, CRI 70, 1 5/8" LEG SPACING	2800	20000	6240-01-353-7708
				5000K, CRI 80, 1 5/8" LEG SPACING	2600	20000	6240-01-373-2687
		31	22.5	3500K, CRI 75, 6" LEG SPACING	2600	20000	6240-01-378-7585
				4100K, CRI 75, 6" LEG SPACING	2600	20000	6240-01-378-7711
				3500K, CRI 85, 6" LEG SPACING	2600	20000	6240-01-378-8043
				4100K, CRI 85, 6" LEG SPACING	2600	20000	6240-01-378-7575
F96T8 (USE WITH F96T8 BALLAST)							
T8	SINGLE PIN	59	96	3500K, CRI 75	5700	15000	6240-01-382-0105
				4100K, CRI 75	5700	15000	6240-01-382-0108
				3500K, CRI 85	6000	15000	6240-01-382-0111
				4100K, CRI 85	6000	15000	6240-01-382-0118

(CG) Cathode Guard is a device designed to reduced end darkening of the lamp.
All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.

Electronic Fluorescent Ballasts

LAMP TYPE	VOLTS	# OF LAMPS	INPUT WATTS	BALLAST FACTOR (%)	MIN START TEMP °F	THD	NATIONAL STOCK NUMBER
Parallel Instant Start Ballasts for 265 mA F32T8, F25T8, F17T8 and corresponding U-Tube lamps							
F32T8; can also be used with F25T8 or F17T8 lamps.	120	1	31	85-92	50	<10%-15%	6250-01-353-7722
		2	61	85-92	50	<10%	6250-01-379-1917
		3	88	93	0	<10%	6250-01-364-2997
		4	112	91	50	<10%	6250-01-364-2999
	277	1	31	85-92	50	<10%-15%	6250-01-353-7723
		2	60	85-92	50	<10%	6250-01-379-3041
		3	88	93	0	<10%	6250-01-364-2998
		4	112	91	50	<10%	6250-01-365-0987
	120	1 or	38	110	50	<25%	6250-01-361-6016
		2	62	95		<20%	
		1(B1) or	36	110	0	<20%	6250-01-364-8906
		2	62	95		<15%	
		3 or	90	95	50	<20%	6250-01-361-6018
		4	112	85			
		3	90	93	0	<20%	6250-01-377-5785
		4	114	91	50	<20%	6250-01-364-8902
	277	1 or	38	110	50	<25%	6250-01-361-6017
		2	62	95		<20%	
		1(B1) or	36	110	0	<20%	6250-01-364-8908
		2	62	95		<15%	
		3 or	90	95	50	<20%	6250-01-381-4451
		4	112	85			
		3	90	90	0	<20%	6250-01-377-5788
		4	114	91	50	<20%	6250-01-364-8904
Instant Start Ballasts for 265 mA F96T8 lamps							
F96T8	120	2	118	92	50	<20%	6250-01-377-7376
	277		118	92	50	<20%	6250-01-381-4453

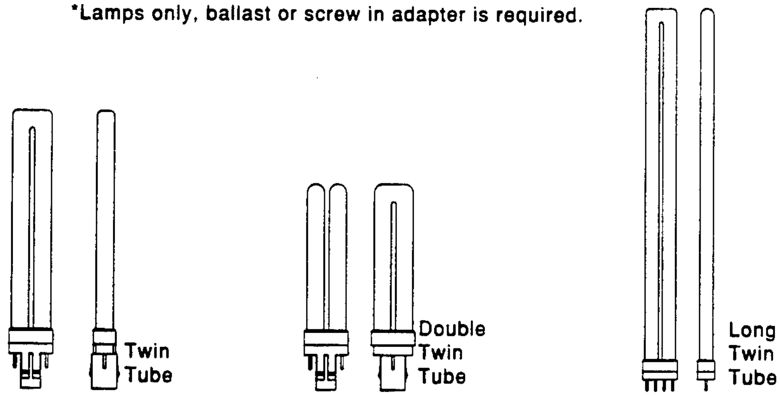
(B1) Not recommended for 1 lamp F17T8 lamp.
All operating characteristics for items in this section were provided by the manufacturer's of these products.

BALLASTS

Compact Fluorescent Lamps*

DTT	Double Twin Tubes
LTT	Long Twin Tube
TT	Twin Tube

*Lamps only, ballast or screw in adapter is required.



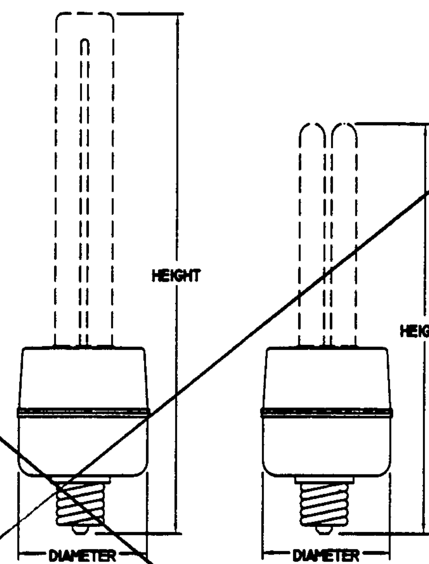
WATTS	LAMP	COLOR/CRI	MOL (inches)	AVG LIFE	INITIAL LUMENS	BASE	NATIONAL STOCK NUMBER
TWIN TUBE LAMPS							
5	TT	2700K, CRI 82	4.125	10000	250	G23	6240-01-344-9531
5	TT	4100K, CRI 85	4.125	10000	250	G23	6240-01-352-0432
7	TT	2700K, CRI 82	5.3125	10000	400	G23	6240-01-306-8247
7	TT	3500K, CRI 82	5.3125	10000	400	G23	6240-01-352-0433
7	TT	4100K, CRI 85	5.3125	10000	400	G23	6240-01-352-0434
[illegible]	TT	2700K, CRI 82	6.5	10000	600	G23	6240-01-344-9532
[illegible]	TT	3500K, CRI 82	6.5	10000	600	G23	6240-01-352-0435
[illegible]	TT	4100K, CRI 85	6.5	10000	600	G23	6240-01-352-0436
[illegible]	TT	2700K, CRI 85	7.4375	10000	900	G23	6240-01-344-9533
[illegible]	TT	3500K, CRI 85	7.4375	10000	900	G23	6240-01-353-7759
[illegible]	TT	4100K, CRI 85	7.4375	10000	900	G23	6240-01-352-0437
DOUBLE TWIN TUBE LAMPS							
[illegible]	DTT	2700K, CRI 82	4.4	10000	575	G23-2	6240-01-383-4126
[illegible]	DTT	3500K, CRI 85	4.4	10000	575	G23-2	6240-01-383-4135
[illegible]	DTT	2700K, CRI 82	5.8	10000	900	GX23	6240-01-345-2252
[illegible]	DTT	3500K, CRI 82	5.8	10000	900	GX23	6240-01-352-0438
[illegible]	DTT	4100K, CRI 85	5.8	10000	900	GX23	6240-01-383-4202
[illegible]	DTT	2700K, CRI 82	6.8	10000	1250	G24d	6240-01-345-2251
[illegible]	DTT	3500K, CRI 85	6.8	10000	1200	G24d	6240-01-352-0439
[illegible]	DTT	4100K, CRI 82	6.8	10000	1250	G24d	6240-01-352-0440
26	DTT	2700K, CRI 82	7.6	10000	1800	G24d	6240-01-345-9535
26	DTT	3500K, CRI 82	7.6	10000	1800	G24d	6240-01-353-7760
[illegible]	DTT	4100K, CRI 82	7.6	10000	1800	G24d	6240-01-352-0441
LONG TWIN TUBE LAMPS							
[illegible]	LTT	3000K, CRI 82	22.5	20000	3150	2G11	6240-01-353-7703
[illegible]	LTT	3500K, CRI 82	22.5	20000	3150	2G11	6240-01-353-7704
[illegible]	LTT	4100K, CRI 82	22.5	20000	3150	2G11	6240-01-353-7705

All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.

LAMPS

Compact Fluorescent Screw-In Adapters

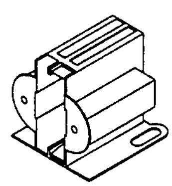
- 50,000 hour average life.
- Magnetic, NPF, toroidal ballast.
- Maximum ambient temperature: 140°F
- UL approved.
- Order lamps separately.



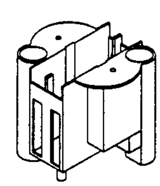
DESCRIPTION	BALLAST LOSSES	MAX LENGTH WITH LAMPS (inches)	MAX DIAMETER	MIN START TEMP (°F)	NATIONAL STOCK NUMBER
5 Watt Adapter, use with 5W twin tube lamps.	1.9	5.5	2	0	6250-01-381-7058
7 Watt Adapter, use with 7W twin tube lamps.	1.5	6.5	2	0	6250-01-381-7189
9 Watt Adapter, use with 9W twin tube or 9W double twin tube lamps.	1.5	8.5 Twin Tube Lamp 5.5 Double Twin Tube	2	0	6250-01-381-6782
13 Watt Adapter, use with 13W twin tube or 13W double twin tube lamps.	2.3	8.9 Twin Tube Lamp 6.2 Double Twin Tube	2.4	0	6250-01-381-6840

Compact Fluorescent Lamp Holders

DESCRIPTION	LAMP WATTAGE AND BASE ACCOMMODATED	NATIONAL STOCK NUMBER
HORIZONTAL SCREW-MOUNT	5, 7 OR 9 WATT, G23 BASE	6250-01-352-1526
	13 WATT, GX23 BASE	6250-01-352-1527
VERTICAL SCREW-MOUNT	5,7 OR 9 WATT, G23 BASE	6250-01-353-4469
	13 WATT, GX23 BASE	6250-01-353-4470
	18 WATT, G240-2 BASE	6250-01-352-1528
	26 WATT, G240-3 BASE	6250-01-352-1529

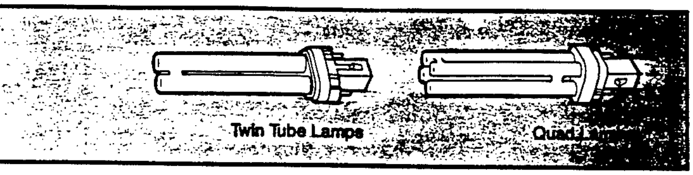


Horizontal



Vertical

All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.



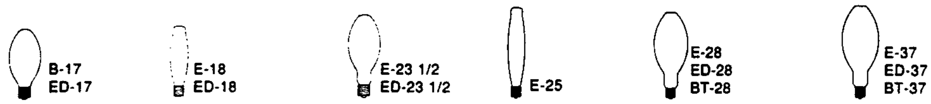
Lamp Data: Description	Lamp Data: Watts	Circuit (Volts)	Min. Starting Temp. (°F.)	Catalog Number (All Class P)†	Notes	Electrical Data: Line Current (Amps)	Electrical Data: Watts Loss	Sound Rating	Dimensions (Pages 22-23)	Wiring Diagram No. (Page 25)	Shipping Data: Units† Std. Ctn.	Shipping Data: Weight Std. Ctn. (Lbs.)
One Lamp—Encapsulated Ballasts—Normal Power Factor												
(1) PL 5, F5TT, (1) Dulux S5	5	120	0	L-1B9-TP	2	.170	3	A	S-2	112	60	45
		277	0	VL-1B9-TP		.180	7	A	R-2	112	30	35
(1) PL 7, F7TT, (1) F7BX, (1) Dulux S7	7	120	0	L-1B9-TP	2	.170	3	A	S-2	112	60	45
		277	0	VL-1B9-TP		.180	7	A	R-2	112	30	35
(1) PL 9, (1) F9TT & DTT, (1) F9BX, (1) Dulux 9 S&DD	9	120	25	L-1B9-TP	2	.170	3	A	S-2	112	60	45
		277	0	VL-1B9-TP		.180	7	A	R-2	112	30	35
(1) PLC 10, (1) Dulux D10	10	120	0	L-1Q13-TP	2	.385	6	A	R-4	108 109	20	40
(1) PL 13, PLC 13 USA, (1) F13TT & DTT, (1) F13 BX, (1) Dulux 13 S&DD	13	120	32	L-1B13-TP	2	.300	4	A	S-2	112	60	45
		277	0	VL-1B13-TP		.300	8	A	R-2	112	30	35
(1) PLC 13, (1) Dulux D13, (1) F13T5	13	120	0	L-1Q13-TP	2	.360	5	A	R-4	108 109	20	40
(1) Thorn 2D16, (1) PLC 18, (1) Dulux D18	16 18 18	120 277	50	L-1Q18-TP VL-1Q18-TP	2	.530 .22	7 5	A	R-4 R-2	108 112	20 30	40 50
(1) PLC 26, (1) Dulux D26, (1) Thorn 2D28	26	120 277	50	L-1Q26-TP VL-1Q26-TP	2	.660 .32	9 7	A	R-4 R-2	108 112	20 30	40 50
One Lamp—Encapsulated Ballasts—High Power Factor & Power Factor Corrected												
(1) PL 5, F5TT, (1) Dulux S5	5	120	25	H-1B9-TP	2	.100	2	A	S-2	111	60	40
		277	0	VH-1B9-TP		.070	7	A	R-2	111	30	34
(1) PL 7, F7TT, (1) F7BX, (1) Dulux S7	7	120	0	H-1B9-TP	2	.100	3	A	S-2	111	60	40
		277	0	VH-1B9-TP		.070	6	A	R-2	111	30	35
(1) PL 9, (1) F9TT & DTT, (1) F9BX, (1) Dulux 9 S&DD	9	120	25	H-1B9-TP	2	.100	3	A	S-2	111	60	40
		277	0	VH-1B9-TP		.070	7	A	R-2	111	30	35
(1) PL 13, PLC 13 USA, (1) F13TT & DTT (1) F13BX (1) Dulux 13 S&DD	13	120	32	H-1B13-TP	2	.150	4	A	S-2	111	60	45
		277	0	VH-1B13-TP		.090	8	A	R-2	111	30	40
(1) PLC 16	16	120	50	H-1Q16-TP	2	.165	3.5	A	R-2	111	30	35
(1) PLC 18	18	120 277	50	H-1Q18-TP VH-1Q18-TP	2	.19 .09	4 6	A	T-1 R-2	111 111	20 30	40 50
(1) PLC 22	22	120	32	H-1Q22-TP	2	.220	4	A	R-2	111	30	40
(1) PLC 26	26	120 277	50	H-1Q26-TP VH-1Q26-TP	2	.31 .13	8 7	A	T-1 R-2	111 111	20 30	40 50
(1) PLC 28	28	120	32	H-1Q28-TP	2	.300	5	A	R-2	111	30	40

NOTES:

2. CSA Approved.

†Ordering Information:
Units shown are furnished with Class P ADVAN-guard® Automatic Resetting Thermostat. Units packed in Individual Cartons—Add suffix—I.

High Pressure Sodium Lamps



WATTS	BASE	BURNING POSITION	BULB	DESCRIPTION	INITIAL LUMENS	MEAN LUMENS	AVG LIFE	NATIONAL STOCK NUMBER
35W, NSI S-76	MEDIUM	ANY	B-17	CLEAR	2250	2025	16000	6240-01-344-9548
				COATED	2150	1935	16000	6240-01-182-1895
50W, NSI S-68	MEDIUM	ANY	B-17	CLEAR	4000	3600	24000	6240-01-143-4812
				COATED	3800	3420	24000	6240-01-182-1894
	MOGUL	ANY	E-23 1/2	CLEAR	4000	3600	24000	6240-01-198-3896
				COATED	3800	3420	24000	6240-01-228-9595
70W, NSI S-62	MEDIUM	ANY	ED-17	CLEAR	6300	5670	24000	6240-01-142-8453
				COATED	5950	5050	24000	6240-01-344-9549
	MOGUL	ANY	E-23 1/2	CLEAR	6300	5450	24000	6240-01-198-3897
				COATED	5860	5050	24000	6240-01-095-5421
[illegible]00W, NSI S-54	MEDIUM	ANY	B-17	CLEAR	9500	8550	24000	6240-01-299-6342
				COATED	8800	7920	24000	6240-01-344-9550
	MOGUL	ANY	E-23 1/2	CLEAR	9500	8550	24000	6240-01-049-2871
				COATED	8800	7920	24000	6240-01-094-2279
[illegible]50W, NSI S-55	MEDIUM	ANY	B-17	CLEAR	16000	14400	24000	6240-01-142-8452
				COATED	15000	13500	24000	6240-01-344-9551
	MOGUL	ANY	E-23 1/2	CLEAR	16000	14400	24000	6240-01-080-9620
				COATED	15000	13500	24000	6240-01-094-2280
				CLEAR,STANDBY ARC TUBE	16000	14400	24000	6240-01-344-9552
[illegible]50W, NSI S-56	MOGUL	ANY	E-28/BT-28	CLEAR	16000	14400	24000	6240-01-344-9964
200W, NSI S-66	MOGUL	ANY	ED-18	CLEAR	22000	19800	24000	6240-01-178-9113
[illegible]0W, SI S-50	MOGUL	ANY	E-18/BT-18	CLEAR	27500	24750	24000	6240-00-551-3098
			E-28	COATED	26000	23400	24000	6240-01-094-8332
			E-18/BT-18	CLEAR,STANDBY ARC TUBE	27500	24750	24000	6240-01-344-9965
[illegible]0W, SI S-67	MOGUL	ANY	ED-18	CLEAR	37000	33300	24000	6240-01-344-9966
[illegible]0W, SI S-51	MOGUL	ANY	ED-18	CLEAR	50000	45000	24000	6240-00-099-6764
			BT-37	COATED	47500	42750	24000	6240-01-233-1093
			E-18	CLEAR,STANDBY ARC TUBE	50000	45000	24000	6240-01-345-9536
[illegible]0W, S-52	MOGUL	ANY	E-25	CLEAR	140000	126000	24000	6240-01-051-2557
			E-25	CLEAR,STANDBY ARC TUBE	140000	126000	24000	6240-01-344-9968

Standby Arc Tube: Allows the lamp to reignite immediately following a power interuption.

All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.

High Intensity Discharge (HID) Ballasts

ABBREVIATIONS	
AR	Autotransformer Reactor: 2 Core System
CWA	Constant Wattage Autotransformer
HX	High Reactance
R	Reactor
HPF	High Power Factor (90% Min.)
NPF	Normal Power Factor (45-60%)
PFC	Power Factor Corrected (75-89%)

Most HID ballasts are supplied as replacement kits. Each kit contains the following:
- Core and Coil Ballast
- Capacitor and Starter (if needed)
- Mounting Brackets
- Installation Instructions

BALLASTS

High Pressure Sodium Ballast Kits

LAMP WATTS, ANSI #	VOLTS	INPUT WATTS	INPUT CURRENT (Amps)	CAPACITANCE (mfd)	CIRCUIT TYPE	# OF LAMPS	NATIONAL STOCK NUMBER
35W, S-76	120	46	0.65	14	R-HPF	1	6250-01-348-6626
	120/277	55	1.0	14	AR-PFC	1	6250-01-348-6627
50W, S-68	120	62	0.95	20	R-HPF	1	6250-01-348-3134
	120/277	80	1.3/0.55	20	AR-PFC	1	6250-01-348-6628
	MV	64	0.58/0.33/0.29/0.25	5	HX-HPF	1	6250-01-348-6632
70W, S-62	MV	88	1.45/0.85/0.75/0.65	7	HX-HPF	1	6250-01-348-5696
100W, S-54	MV	130	2.2/1.27/1.1/0.85	10	HX-HPF	1	6250-01-348-5324
150W, S-56	MV	200	3/1.65/1.45/1.25	14	HX-HPF	1	6250-01-198-6054
150W,S-55	MV	188	1.75/1.0/0.88/0.75	20	CWA	1	6250-01-352-8004
200W, S-66	MV	245	2.25/1.3/1.2/1	28	CWA	1	6250-01-348-5325
250W, S-50	MV	300	2.75/1.6/1.38/1.2	35	CWA	1	6250-01-348-6629
310W, S-67	MV	365	3.4/1.95/1.7/1.45	45	CWA	1	6250-01-348-6631
400W, S-51	MV	457	3.9/2.25/1.95/1.7	55	CWA	1	6250-01-348-6630
1000W, S-52	MV	1100	9.5/5.5/4.8/4.2	26	CWA	1	6250-01-348-7439

MV = MULTI VOLTAGE (120/208/240/277)

Near Incandescent Quality HPS Ballasts

[illegible]P WATTS, ANSI #	VOLTS	INPUT WATTS	INPUT CURRENT (Amps)	CAPACITANCE (mfd)	CIRCUIT TYPE	# OF LAMPS	NATIONAL STOCK NUMBER
Includes ballast with integral ignitor, capcitor for NPF correction and 120/277v transformer where applicable.							
[illegible]W, S-99	120/277	50	0.40	20	HYBRID	1	6250-01355-2262
[illegible]W, S-104	120/277	70	0.57	28	HYBRID	1	6250-01-355-2263
[illegible]	120	118	1.25		ELEC.	1	6250-01-355-2265
[illegible]W, S-105	120/277	129	1.00	45	HYBRID	1	6250-01-355-2264

All operating and physical characteristics for items in this section were provided by the manufacturer's of these products.

APPENDIX I

Compressed Air System Modification Evaluations

APPENDIX I
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Compressed Air System Modification Evaluations

Compressed air is provided from the central plant, Building 117-2, to WADF facilities. Three air compressors are connected in parallel to the distribution system which is partly above and partly below ground. The system is shown schematically on Figure I-1.

Existing compressors are deteriorated; in fact, only one was operational at the time of field investigations. Run-time meters installed on each compressor indicate that the systems have been operated for only a fraction of their ages. The following data were observed:

Air Compressor 1	9,893 Hours, total run-time	18 years old
Air Compressor 2	10,999 Hours, total run-time	18 years old
Air Compressor 3	19,122 Hours, total run-time	18 years old

Much higher run times are expected for 18-year old machines; on the order of 50,000 total hours or more.

Compressed air from the central plant, Plant Air, is distributed to WADF buildings at about 115 psig. Plant Air is used as motive force in HVAC system damper actuators and for process uses.

In most mechanical rooms, Plant Air and instrument air systems have been interconnected. This was done to retain control in the event of a central plant shutdown; however, interconnections have remained open. This has lead to contamination of sensors and controls which are not designed for even the small amounts of oil found in Plant Air. System interconnections should be removed. HVAC control system retrofit calculations provided in Appendix D assume replacement of existing pneumatic control systems with DDC controls, effectively eliminating the need for instrument compressed air service. Plant Air is still required to provide motive force for damper actuators and other control devices.

Existing air compressors are in need of complete overhauls. Replacement of the existing air compressors and ancillary equipment (oil and air coolers and refrigerated air dryers) should be considered.

Based on manufacturers catalog data, performance of the existing plant air compressors is as follows:

Compressor Nameplate Data:

Ingersoll-Rand Model:	PA150	S/N:	96076U76859
Motor:	200 HP		
Operating. Pressure:	115 psig		
Full Load Capacity at 100 psig:	680 Actual Cubic Feet per Minute (ACFM)		
Full Load BHP at 100 psig:	150 BHP		
Compressor Efficiency:	22.06 BHP/100ACFM		
Motor Efficiency:	92.5%		

Compressor Power Consumption Measurement:		96%	PF
(Averages of three measurements)		135.3	RLA
		484	Volts, 3 Phase
	680 CFM	108.9	kW based on measurement
	680 CFM	121.0	kW based on nameplate data

Refrigerated Air Dryer One air dryer is installed, as shown on Figure I-1, for each air compressor.

Nameplate Data: Ingersoll-Rand Model No. MN 14, S/N: 14D0576002, 3 and 4

Model 14 performance data is not available, however, Ingersoll-Rand Model Nos. 11 & 12 performance is:

Model 11:	575 CFM @ 440 VAC 11.0 A 0.96 PF =	8.05	kW, or
	Model 11	1.40	kW / 100 SCFM
Model 12:	700 CFM @ 440 VAC 13.5 A 0.96 PF =	9.88	kW, or
	Model 12	1.41	kW / 100 SCFM
	Assume Model 14 has the same performance:	1.40	kW / 100 SCFM
	Thus, at 680 CFM, the electrical demand is:	9.5	kW

SCFM = Standard Cubic Feet per Minute

Operating Problems:

Operators at Building 117-6 state that when sludge presses at 117-6 & 117-7 are dumped, the air pressure at Buildings 117-5 & 117-8 drops. All systems except manipulators run at 15 psig. Manipulators at building 117-5 & 117-8 require at least 80 psig compressed air to operate.

Significant plant air leaks were found at Building 117-6 (oil separator glass broken) and at Building 117-11 (top of the conveyor hopper from Building 117-10). Overall, leaks appear to constitute a hole of about 3/8" in diameter. The leakage rate is calculated as follows:

Mass Flow Rate Calculation:

For air;	R =	53.3	Ft/°R & k =	1.4	
	P =	105	psig & T =	85	°F

$p_1 / RT_1 =$ (105 + 14.7) psig x 144 in^2/SF ÷ (53.3 x (460 + 85)) = 0.5934 lf/ft^3

Critical $(p_2 / p_1) = (2 / (k + 1))^{k/(k-1)} = (2.0 / 2.4)^{1.40\ /\ 0.40} =$ 0.528

Ratio (atmosphere / system pressure) = 14.7 / 119.7 = 0.123

Since this latter ratio is less than the critical pressure ratio, the pressure of the escaping gas = 0.528 x p_1. Hence p_2 = 0.528 x 119.7 = 63.2 psia

$V_2 = c_2$ = Square Root (1.4 x 32.2 x 53.3 x T_2) = Square Root (2402.764 T_2)

where $T_2/T_1 = (p_2/p_1)^{(k-1)/k} = (0.528)^{0.40/1.40} =$ 0.833, then T_2 = 454 °R

Then V_2 = Square Root (2402.764 x 454) = 1,045 Ft/Sec

Volumetric flow rate: 192 ACFM at -6°F, the capacity of the air compressor.
224 SCFM

This air leakage rate, 192 ACFM is 28.3% of a single air compressor's capacity, and is probably the reason for the operating problems addressed above.

Present Compressed Air System Power Consumption

Without considering process compressed air consumption, the air leakage rate calculated above consumes: 195,588 kWH per year of electric power. Calculated as follows:

(Measured Compressor kW + Refrigerated Air Dryer kW) x (% of Compressor Capacity Devoted to Leaks) x Hours per Year of Operation

Process compressed air consumption is assumed to require operation of compressors for 5 additional hours per day now, constituting about 184,756 kWH per year of additional power consumption, for a total 380,345 kWH per year of compressed air system power use.

Estimates for future use are based on 2 compressors operating 8 hours per day 6 days per week. The longer operating hours per day allow for operation of WADF at closer to its capacity.

Proposed Compressed Air System Repairs and Energy Saving Options

Energy Saving Opportunities

Proposed energy conservation opportunities for the compressed air system (refer to Appendix A, Energy Engineering Analysis Program Study and Criteria Review, Table 3-1, ECO No. 8.) included suggestions to lower the compressed air pressure and increase storage volume. Neither approach is technically feasible at WADF. Manipulators in the Refining and Mechanical Removal buildings require at least 80 psig; the pressure must be maintained high enough at the central plant (building 117-2) in order to provide the required pressure at the point of use (building 117-8), farthest from the plant. Storage volume could be increased, however, this would only result in reducing cycle frequency for the system, a problem that should be cleared up by fixing air leaks.

Repairs Required

Existing air compressors need rebuilding and renovation due to their inactivation for a number of years. Two of the three air compressors are currently undergoing repairs, and are partially disassembled. It is assumed that all three existing compressors require "air-end" rebuilds and control system renovations. Based on discussions with an Ingersoll-Rand representative, budget cost for such a rebuild can be expected to require \$8,000 to \$10,000 for the air-end rebuild with an additional \$2,000 to \$3,000 for on-site labor and materials for installation and control system renovation. Bare cost per unit for air-end rebuilds and control system repairs is, thus: \$13,000 ; total for 3 units is = \$39,000

Repairs are required for the Building 117-6 oil separator glass and the Building 117-11 conveyor hopper air valve to stop air leaks which presently constitute the largest compressed air load on the system.

Repairing leaks alone will save about: 195,588 kWH per year \$8,558 per year savings

The following proposed system modifications are considered assuming this renovation & repair expense is avoided.

Replacement Options for Air Compressors and Air Dryers

The existing PA150 air compressors are rated to produce 680 ACFM at 19.19 kW / 100 ACFM. Three compressors are installed, two operating and one spare. A single compressor currently carries the load, however, most of the WADF buildings are not presently operating. Replacement options consider providing the same capacity of compressed air service as was originally installed.

Alternative 1: Replace Existing System with Ingersoll-Rand Model SSR XFE300-2S and Desiccant Air Dryer

Capacity ,thus, performance of the proposed air compressor is reduced by 15% for the desiccant air dryer. A desiccant air dryer requires about 15% of the compressor output for regeneration of the desiccant. Desiccant air dryers are available with only about 7% purge requirements; however, electric heating elements are installed to compensate for the reduced compressed air supply.

Presently, two PA150 air compressors can provide about 1,360 ACFM of 100 psig air. Allowing for the loss of 15% of the capacity for use in desiccant air dryers, about 1,600 ACFM at 100 psig is required. Based on catalog data, an Ingersoll-Rand two stage rotary screw air compressor, model number SSR XFE300-2S, is selected as a replacement air compressor.

Operating parameters are: 1,602 ACFM at 100 psig, one 300 HP Motor of 95.2% efficiency
Modern controls allow air volume provided to modulate with demand.

A desiccant air dryer is provided to replace the existing refrigerated air dryers. The desiccant dryer uses essentially no power, relying on compressed air for desiccant recharging. Two desiccant columns are provided to allow one in operation while the other is being recharged.

The rotary screw air compressor is air cooled. Costs are allowed for ducting fresh outside air into and out of the air compressor for cooling purposes. This allows the existing air/oil coolers located outside building 117-2 to be removed from service.

Energy savings and economic analysis results are summarized on Table I-1. Costs associated with this proposed retrofit include: Cost of the new air compressor and desiccant air dryer, ductwork required for cooling air and avoided costs of repairing the three existing air compressors and refrigerated air dryer sets. Backup compressed air service is assumed available from instrument air compressors located in each of the WADF building mechanical rooms.

Alternative 2: Replace Existing System with Ingersoll-Rand Model SSR XFE250-2S, use Existing Refrigerated Air Dryers

This alternative is similar to Alternative 1 presented above, except existing refrigerated air dryers are to be retained in service rather than installing desiccant air dryers. Because the desiccant air dryers are not to be installed, the compressor need not have as high a capacity. Consequently, an Ingersoll-Rand Two-Stage Rotary Screw Air Compressor, Model SSR XFE250-2S is selected.

Operating parameters are: 1,355 ACFM at 100 psig, one 250 HP Motor of 95.2% efficiency
Modern controls allow air volume provided to modulate with demand.

Energy savings and economic analysis results are summarized on Table I-1. Costs associated with this proposed retrofit include: Cost of the new air compressor and repair or replacement of the existing refrigerated air dryers and avoided costs of repairing the three existing air compressors. Backup compressed air service is assumed available from instrument air compressors located in each of the WADF building mechanical rooms. These compressors are currently interconnected with the Plant Air system and will be deenergized as a result of DDC control retrofits proposed for building HVAC systems.

Alternative 3: Replace Existing System with Two Ingersoll-Rand Model LL5 and Desiccant Air Dryer

This proposed replacement option is similar to the Alternative 1 described above. It is proposed to replace the three existing Ingersoll-Rand PA 150 air compressors with two Ingersoll-Rand LL5 reciprocating air compressors and desiccant air dryers. The LL5 line of air compressors is water cooled, thus, a cooling water system is required for each of the air compressors.

Operating parameters are: Two LL5 Reciprocating, Water Cooled Air Compressors, each delivering 810 ACFM at 100 psig, one 150 HP Motor each of 92.5% efficiency.

The desiccant air dryer requires 15% of the compressed air produced, thus, the compressors are oversized to allow for desiccant regeneration. The existing air/oil coolers located outside building 117-2 are removed from service.

Energy savings and economic analysis results are summarized on Table I-1. Costs associated with this proposed retrofit include: Cost of the new air compressors and desiccant air dryers and avoided costs of repairing the three existing air compressors and refrigerated air dryer sets. Backup compressed air service is assumed available from instrument air compressors located in each of the WADF building mechanical rooms. These compressors are currently interconnected with the Plant Air system and will be deenergized as a result of DDC control retrofits proposed for building HVAC systems.

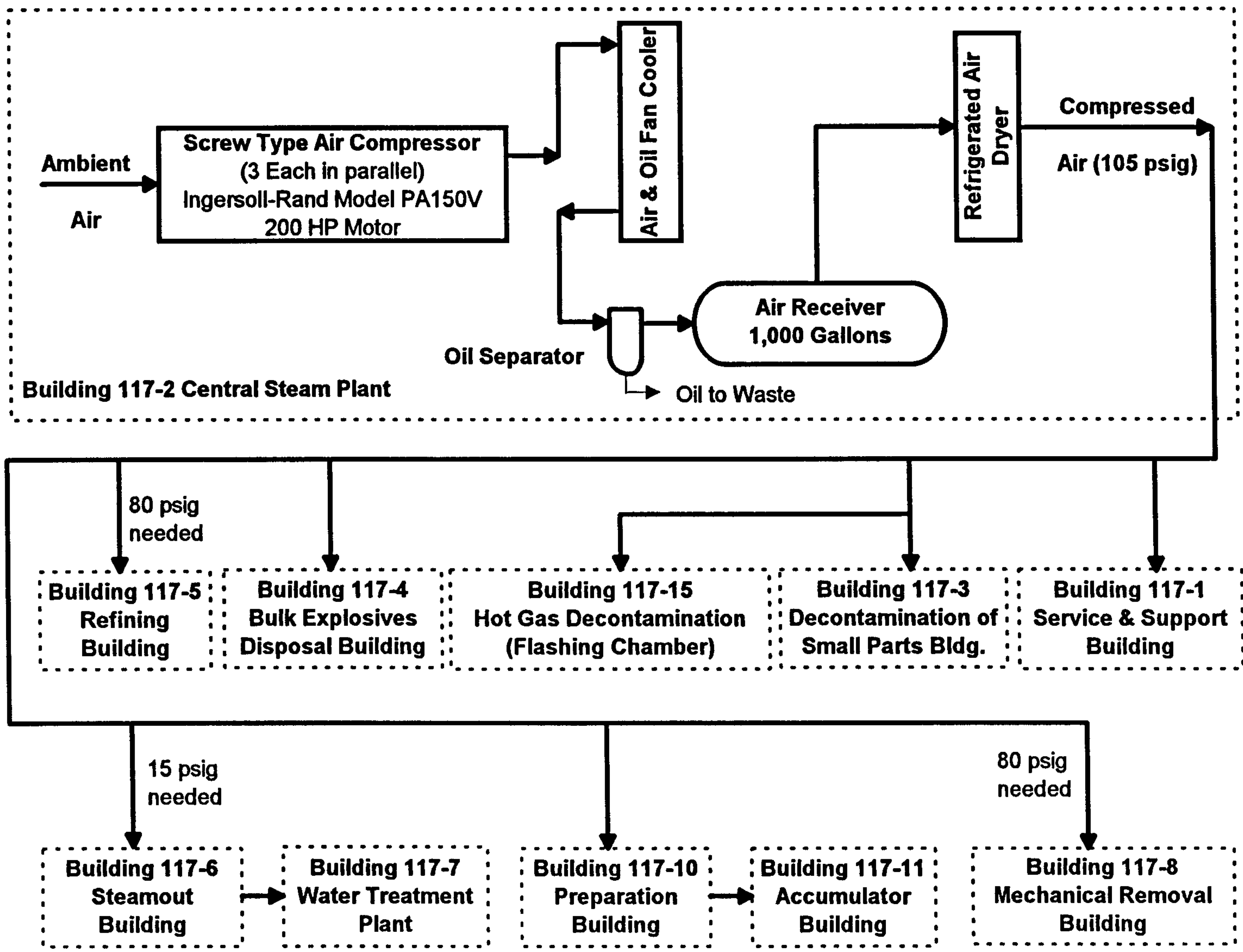
Alternative 4: Replace Existing System with Ingersoll-Rand Model LL5 Reciprocating Air Compressors, use Existing Refrigerated Air Dryers

This alternative is similar to Alternative 3, the LL5 air compressor alternative presented above, except existing refrigerated air dryers are to be retained in service; desiccant air dryers are not to be installed. Because the desiccant air dryers are not to be installed, the replacement compressors need not have as high capacities. Consequently, two 125 HP Ingersoll-Rand LL5 reciprocating air compressors are selected. The LL5 line of air compressors is water cooled, thus, a cooling water system is required for each of the air compressors.

Operating parameters are: Two LL5 Reciprocating, Water Cooled Air Compressors, each delivering 634 ACFM at 100 psig, one 125 HP Motor each of 92.5% efficiency.

Energy savings and economic analysis results are summarized on Table I-1. Costs associated with this proposed retrofit include: Cost of the new air compressors and repair or replacement of the existing refrigerated air dryers and avoided costs of repairing the three existing air compressors. Backup compressed air service is assumed available from instrument air compressors located in each of the WADF building mechanical rooms. These compressors are currently interconnected with the Plant Air system and will be deenergized as a result of DDC control retrofits proposed for building HVAC systems.

Figure I-1. WADF Compressed Air Distribution System Schematic Diagram



Revised March 1995

Table I-1. Summary of Air Compressor Retrofit Option Evaluations

Compressor & Air Dryer Description	Capacity ACFM	Connected kW	Eq. Hours per Year	Power kWH/Yr	kW Saved	kWH/Yr Saved	Elec Saved $/Year	LCC$ Saved	Investment $	SIR
Existing Installation: (values indicated based on 2 operating, 1 standby)								Assumed		
3 x I-R PA150 Air Compressors, and	1,360	242	1,662	441,308	-	-	-	20 Year	-	-
3 x I-R MN14 Refrigerated Air Dryers	Total	19		195,588				Compressor		
3 x Aftercooler / Oil Cooler (Exterior)		4.5	See Note 1	See Note2				Lifetime		
Alternative 1: Replacement I-R MN SSR XFE300-2S and Desiccant Air Dryer										
1 x I-R SSR XFE300-2S Compressor	1,602	224	1,660	371,566	41.7	265,330	$15,868	$239,297	$182,761	1.63
1 x Desiccant Air Dryer (requires 15% of compressor output for regeneration)									Payback Years =	10.04
Alternative 2: Replacement I-R SSR XFE250-2S with Existing Refrigerated Air Dryers										
1 x I-R SSR XFE250-2S Compressor	1,355	187	1,668	342,937	59.9	293,959	$18,987	$286,329	$166,795	1.86
2 x I-R MN14 Extg. Refr. Air Dryers	Total	19							Payback Years =	8.52
Alternative 3: Replacement I-R MN LL5 and Desiccant Air Dryer										
2 x I-R LL5 Air Compressors 150 HP	1,620	224	1,642	379,686	34.2	257,211	$14,751	$222,442	$235,684	1.15
2 x Cooling Systems (Water Cooling)		7							Payback Years =	14.40
2 x Desiccant Air Dryers (require 15% of compressor outputs for regeneration)										
Alternative 4: Replacement I-R MN LL5 with Existing Refrigerated Air Dryers										
2 x I-R LL5 Air Compressors 125 HP	1,268	187	1,783	379,768	48.0	257,129	$16,156	$243,632	$240,202	1.05
2 x Cooling Systems (Water Cooling)		7							Payback Years =	15.24
2 x I-R MN14 Extg. Refr. Air Dryers	Total	19								

Note 1: Operating hours per year assume that the air compressors are operating 33% of the scheduled WADF operating hours (16 hours/day, 6 days/week). Operating hours for proposed replacement options are adjusted to provide the same amount of compressed air as the existing PA 150 compressors.
Note 2: Power consumption due to leaks in the existing system is added to the "base case" and repair costs are expensed for each alternative.

Recommended Option: **Replace air compressors with Ingersoll-Rand Model SSR XFE250-2S 2-stage rotary screw air compressor, use existing refrigerated air dryers**

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY96
Alternative 1: Replace Air Compressors with Ingersoll-Rand Model SSR XFE300-2S 2-Stage Rotary Screw Air Compressor and Desiccant Air Dryer

Analysis Date: March 1995 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs			
A. Construction Costs	$163,180		
B. SIOH	$ 9,791		
C. Design Cost	$ 9,791		
D. Total Cost (1A+1B+1C)	$ 182,761		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$182,761

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	906		$11,609	15.08	$175,065
B. Dist	$6.13			$0	18.57	$0
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	41.7	kW	$4,259	15.08	$64,232
F. Total		906		$15,868		$239,297

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($2,448)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($36,422)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$95,528	0	1.000	$95,528
b.				
c.				
d. Total	$95,528			$95,528

C Total Non Energy Discounted Savings (3A2+3Bd4) $59,106

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$18,197	
5. Simple Payback (1G/4):	10.04	Years
6. Total Net Discounted Savings (2F5+3C):	$298,403	
7. Savings to Investment Ratio (SIR) 6/1G:	1.63	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY96

Alternative 2: Replace Air Compressors with Ingersoll-Rand Model SSR XFE250-2S 2-Stage Rotary Screw Air Compressor, use existing air dryers

Analysis Date: March 1995 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$148,924		
B. SIOH	$ 8,935		
C. Design Cost	$ 8,935		
D. Total Cost (1A+1B+1C)	$ 166,795		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$166,795

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	1,003		$12,862	15.08	$193,954
B. Dist	$6.13			$0	18.57	$0
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	59.9	kW	$6,126	15.08	$92,375
F. Total		1,003		$18,987		$286,329

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($2,234)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($33,240)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$56,470	0	1.000	$56,470
b.				
c.				
d. Total	$56,470			$56,470

C Total Non Energy Discounted Savings (3A2+3Bd4) $23,231

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)): $19,577
5. Simple Payback (1G/4): 8.52 Years
6. Total Net Discounted Savings (2F5+3C): $309,560
7. Savings to Investment Ratio (SIR) 6/1G: 1.86

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY96

<u>Alternative 3</u>: **Replace Air Compressors with Ingersoll-Rand Model LL5 & Desiccant Air Dryer**

Analysis Date: March 1995 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$210,432		
B. SIOH	$ 12,626		
C. Design Cost	$ 12,626		
D. Total Cost (1A+1B+1C)	$ 235,684		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$235,684

2. Energy Savings (+)/Cost(-):
Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	877.9		$11,254	15.08	$169,708
B. Dist	$6.13			$0	18.57	$0
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	34.2	kW	$3,497	15.08	$52,734
F. Total		878		$14,751		$222,442

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($3,156)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($46,968)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$95,528	0	1.000	$95,528
b.				
c.				
d. Total	$95,528			$95,528

C Total Non Energy Discounted Savings (3A2+3Bd4) $48,560

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)): $16,371
5. Simple Payback (1G/4): 14.40 Years
6. Total Net Discounted Savings (2F5+3C): $271,001
7. Savings to Investment Ratio (SIR) 6/1G: 1.15

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY96

<u>Alternative 4</u>: **Replace Air Compressors with Ingersoll-Rand Model LL5, use existing dryers**

Analysis Date: March 1995 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$214,466		
B. SIOH	$ 12,868		
C. Design Cost	$ 12,868		
D. Total Cost (1A+1B+1C)	$ 240,202		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$240,202

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	878		$11,250	15.08	$169,653
B. Dist	$6.13			$0	18.57	$0
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	48.0	kW	$4,906	15.08	$73,979
F. Total		878		$16,156		$243,632

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($3,217)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($47,869)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	$56,470	0	1.000	$56,470
b.				
c.				
d. Total	$56,470			$56,470

C Total Non Energy Discounted Savings (3A2+3Bd4) $8,602

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$15,763	
5. Simple Payback (1G/4):	15.24	Years
6. Total Net Discounted Savings (2F5+3C):	$252,234	
7. Savings to Investment Ratio (SIR) 6/1G:	1.05	

CONSTRUCTION COST ESTIMATE

Date Prepared: March-95
Sheet 1 of 1

Project: ECIP Facility Energy Improvements

Project No.:

Basis for Estimate: Code A (no design competed)

Location: Western Area Demilitarization Facility (WADF)
Hawthorne Army Ammunition Plant, Nevada

Engineer-Architect: Keller & Gannon

Drawing No.:

Estimator: BIH

Checked By: RCL

Line Item	Quantity: No. Units	Quantity: Unit Meas.	Labor: Per Unit	Labor: Total	Material: Per Unit	Material: Total	Total Cost
Repair / Rebuild Costs for Both Compressors and Refrigerated Air Dryers							
Ingersoll-Rand PA150 Compressor Air-End Rebuild	3	EA	Included		$10,000	$30,000	$30,000
Replace/Repair Refrigerated Air Dryers, Ingersoll-Rand MN14	3	EA	Included		$8,991	$26,974	$26,974
Ingersoll-Rand PA150 Compressor Controls Repairs & Renovation	3	EA	Included		$3,000	$9,000	$9,000
Subtotal			Included			$65,974	$65,974
Nevada Sales Tax	3.75%	%		-		$2,474	$2,474
Subtotal							$68,448
Contractor OH & Profit	25.0%	%					$17,112
Subtotal							$85,560
Bond	1.5%	%					$1,283
Subtotal							$86,844
Estimating Contingency	10.0%	%					$8,684
Total Probable Construction Cost							**$95,528**
Repair / Rebuild Costs for Air Compressors Only							
Ingersoll-Rand PA150 Compressor Air-End Rebuild	3	EA	Included		$10,000	$30,000	$30,000
Ingersoll-Rand PA150 Compressor Controls Repairs & Renovation	3	EA	Included		$3,000	$9,000	$9,000
Subtotal			Included			$39,000	$39,000
Nevada Sales Tax	3.75%	%		-		$1,463	$1,463
Subtotal							$40,463
Contractor OH & Profit	25.0%	%					$10,116
Subtotal							$50,578
Bond	1.5%	%					$759
Subtotal							$51,337
Estimating Contingency	10.0%	%					$5,134
Total Probable Construction Cost							**$56,470**

CONSTRUCTION COST ESTIMATE

CONSTRUCTION COST ESTIMATE	Date Prepared: March-95	Sheet 1 of 2
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate: Code A (no design competed)
Location: Western Area Demilitarization Facility (WADF), Hawthorne Army Ammunition Plant, Nevada		
Engineer-Architect: Keller & Gannon		
Drawing No. Compressed Air System Replacement with SSR Compressor	Estimator: B. I. Horst	Checked By: R. C. Lennig

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Alternative 1: Replacement SSR XFE300-2S Air Cooled Air Compressor & Desiccant Air Dryer							
Ingersoll-Rand SSR XFE300-2S Two Stage Rotary Screw Air Compressor	1	EA	$4,282	$4,282	$85,000	$85,000	$89,282
Heatless Desiccant Air Dryer, Ingersoll Rand HRD60 (1700 CFM)	1	EA	$761.84	$762	$18,390	$18,390	$19,152
Cooling Air Supply and Exhaust Ductwork thru Building Wall	1	Job	$2,678	$2,678	$1,500	$1,500	$4,178
Repair of Compressed Air Leaks	1	Job	$169	$169	$200	$200	$369
Subtotal				$7,891		$105,090	$112,981
Nevada Sales Tax	3.75%	%		-		$3,941	$3,941
Subtotal							$116,922
Contractor OH & Profit	25.0%	%					$29,231
Subtotal							$146,153
Bond	1.5%	%					$2,192
Subtotal							$148,345
Estimating Contingency	10.0%	%					$14,835
Total Probable Construction Cost							**$163,180**
Alternative 2: Replacement SSR XFE300-2S Air Cooled Air Compressor & Desiccant Air Dryer							
Ingersoll-Rand SSR XFE250-2S Two Stage Rotary Screw Air Compressor	1	EA	$4,040	$4,040	$68,000	$68,000	$72,040
Replace/Repair Refrigerated Air Dryers, Ingersoll-Rand MN14 or equal	3	EA	Included		$8,991	$26,974	$26,974
Cooling Air Supply and Exhaust Ductwork thru Building Wall	1	Job	$2,510	$2,510	$1,200	$1,200	$3,710
Repair of Compressed Air Leaks	1	Job	$169	$169	$200	$200	$369
Subtotal				$6,719		$96,374	$103,094
Nevada Sales Tax	3.75%	%		-		$3,614	$3,614
Subtotal							$106,708
Contractor OH & Profit	25.0%	%					$26,677
Subtotal							$133,385
Bond	1.5%	%					$2,001
Subtotal							$135,385
Estimating Contingency	10.0%	%					$13,539
Total Probable Construction Cost							**$148,924**

For Life Cycle Cost Analysis, assume existing air compressors and refrigerated air dryer repairs must be performed. These costs are expensed year "0" in the Life Cycle Cost Analysis Summary. **$95,528**

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year:
Option with Desiccant Air Dryers: **$2,448** per year.
Option with existing Refrigerated Air Dryers: **$2,234** per year.

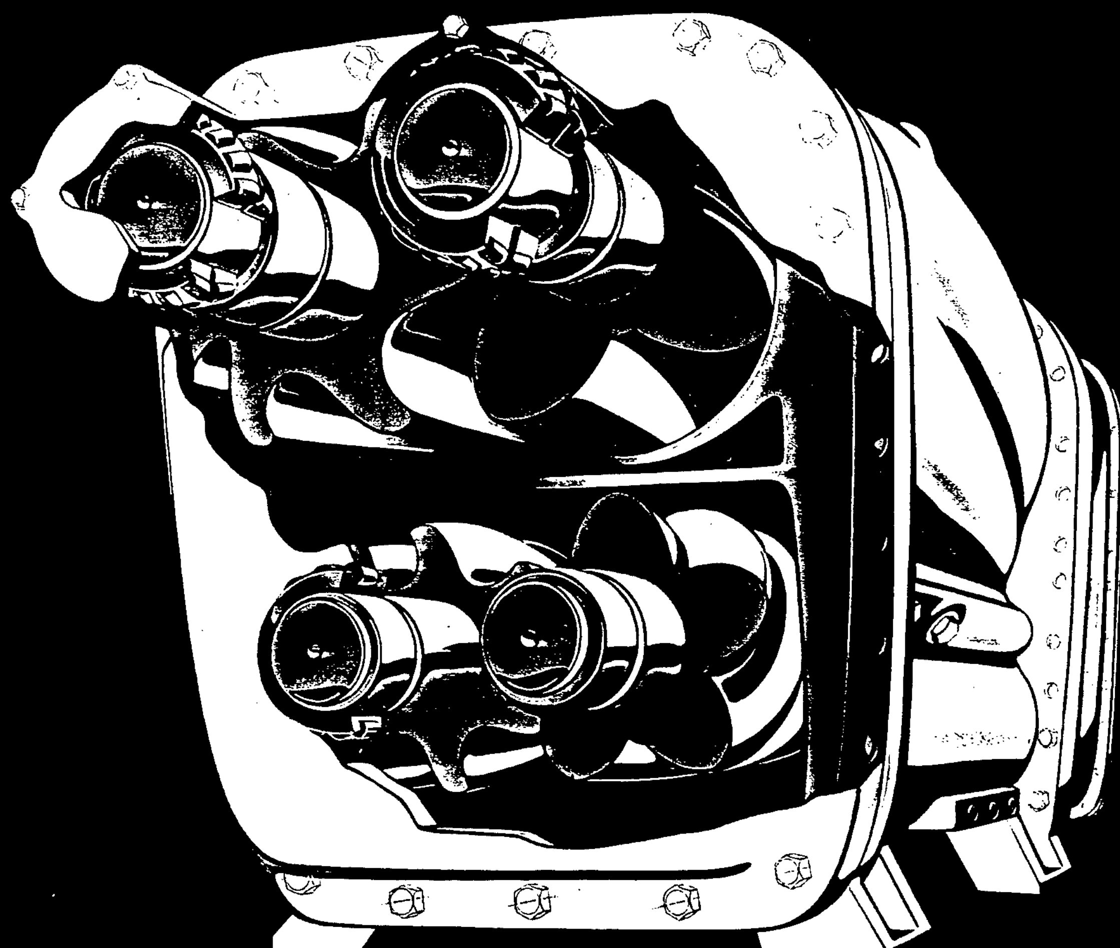
CONSTRUCTION COST ESTIMATE	Date Prepared March-95	Sheet 2	of 2
Project: ECIP Facility Energy Improvements	Project No.	Basis for Estimate: Code A (no design competed)	
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada			
Engineer-Architect: Keller & Gannon			
Drawing No. Compressed Air System Replacement with LL5 Compressors	Estimator: B. I. Horst	Checked By: R. C. Lennig	

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Alternative 3: Replacement LL5 Water Cooled Air Compressors & Desiccant Air Dryers							
Ingersoll-Rand LL5 Air Compressor to Replace Existing PA 150 Compressor	2	EA	$6,423	$12,846	$45,000	$90,000	$102,846
Heatless Desiccant Air Dryer, Ingersoll Rand HRD (600 CFM)	2	EA	$304.74	$609	$9,623	$19,246	$19,855
Cooling Water System for I-R LL5 Air Compressor	2	EA	$1,427	$2,855	$10,000	$20,000	$22,855
Repair of Compressed Air Leaks	1	Job	$169	$169	$200	$200	$369
Subtotal				$16,480		$129,446	$145,926
Nevada Sales Tax	3.75%	%		-		$4,854	$4,854
Subtotal							$150,780
Contractor OH & Profit	25.0%	%					$37,695
Subtotal							$188,475
Bond	1.5%	%					$2,827
Subtotal							$191,302
Estimating Contingency	10.0%	%					$19,130
Total Probable Construction Cost							**$210,432**
Alternative 4: Replacement I-R MN LL5 with Existing Refrigerated Air Dryers							
Ingersoll-Rand LL5 Air Compressor to Replace Existing PA 125 Compressor	2	EA	$6,423	$12,846	$42,750	$85,500	$98,346
Cooling Water System for I-R LL5 Air Compressor	2	EA	$1,503	$3,005	$10,000	$20,000	$23,005
Replace/Repair Refrigerated Air Dryers, Ingersoll-Rand MN14	3	EA	Included		$8,991	$26,974	$26,974
Repair of Compressed Air Leaks	1	Job	$169	$169	$200	$200	$369
Subtotal				$16,021		$132,674	$148,695
Nevada Sales Tax	3.75%	%		-		$4,975	$4,975
Subtotal							$153,670
Contractor OH & Profit	25.0%	%					$38,418
Subtotal							$192,088
Bond	1.5%	%					$2,881
Subtotal							$194,969
Estimating Contingency	10.0%	%					$19,497
Total Probable Construction Cost							**$214,466**

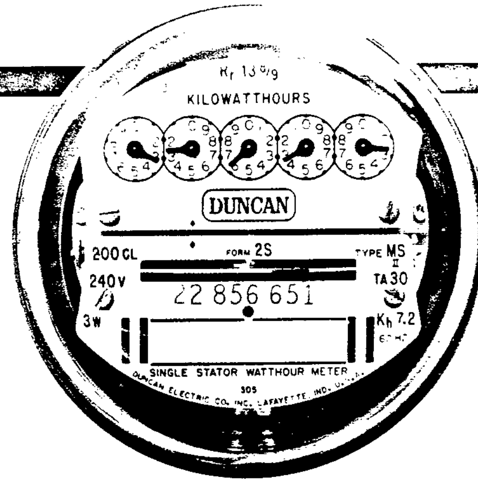
For Life Cycle Cost Analysis, assume existing air compressors and refrigerated air dryer repairs must be performed. These costs are expensed year "0" in the Life Cycle Cost Analysis Summary. $95,528

Annual O&M expenses are assumed equal to 1.5% of the construction costs per year:
Option with Desiccant Air Dryers: **$3,156** per year.
Option with existing Refrigerated Air Dryers: **$3,217** per year.

Rotary Screw Air Compressors
SSR 2-Stage



INGERSOLL-RAND®
AIR COMPRESSORS

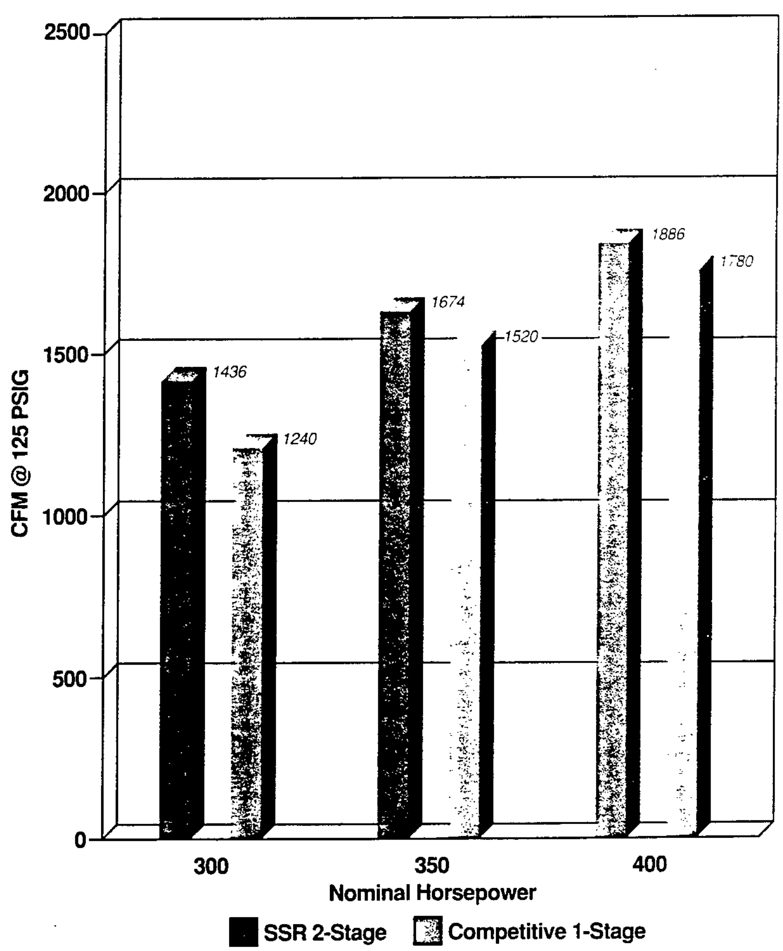


Throughout the world, industry has come to depend on Ingersoll-Rand SSR rotary screw compressors for reliability, lower installation and operating costs, and superior designs.

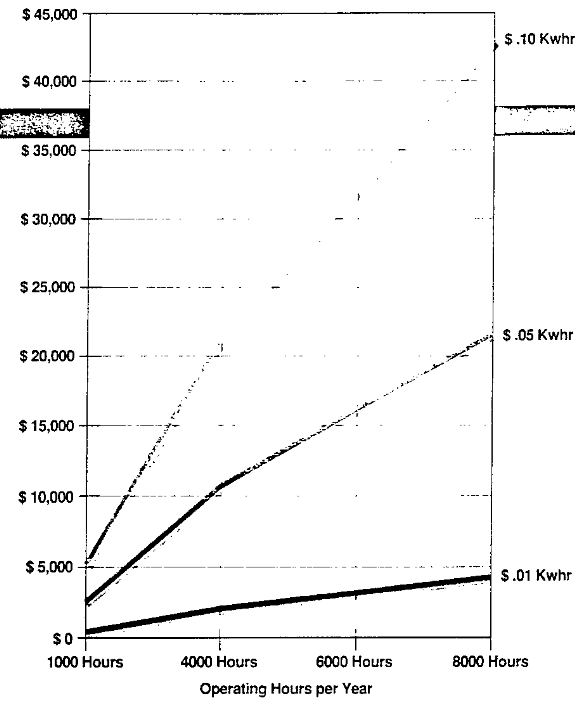
Now, Ingersoll-Rand has really stacked things in your favor with the SSR 2-Stage series of rotary screw air compressors. The advanced, stacked, two stage airend technology saves up to 15% in kilowatt costs, and when combined with our unique Intellisys stepper motor capacity control, gives you an exceptional combination of superior compressor technology and low operating costs.

The pairs of rotors in SSR 2-stage compressors fit into a combined airend assembly. Compression is shared between the first and second stages flowing in series. This increases overall compression efficiency up to 15% of the total full load kilowatt consumption. You can enjoy these savings for only a modest increase in capital cost over that of single stage rotary screw compressors.

SSR 2-Stage Efficiency



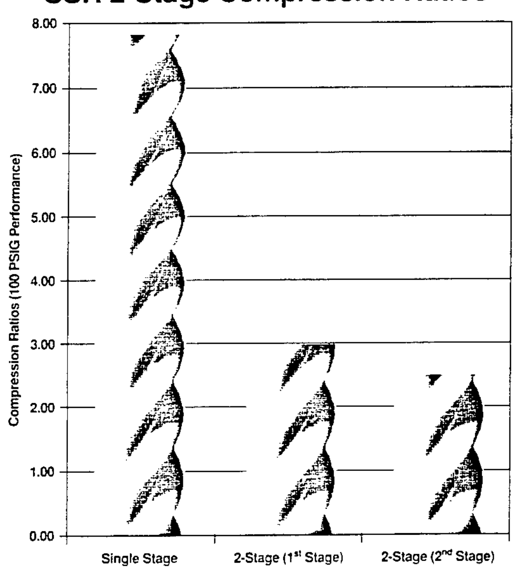
2-Stage Savings



Energy savings go a long way to reduce your compressor's initial cost and operating expenses. As a rule of thumb, our SSR 2-Stage compressor will save you up to $ 534 per 1,000 hours of operation, basis a kilowatt cost of $ .01 per kilowatt hour (when compared to single stage compressors). If your power cost is $ .05 per kilowatt, and you operate 6,000 hours per year, your first year savings could be as great as $ 16,000! Savings like these quickly recover the capital cost increment of the SSR 2-Stage over single stage rotary compressors, and it won't take long for the savings to return the entire cost of the compressor. Now that's significant!

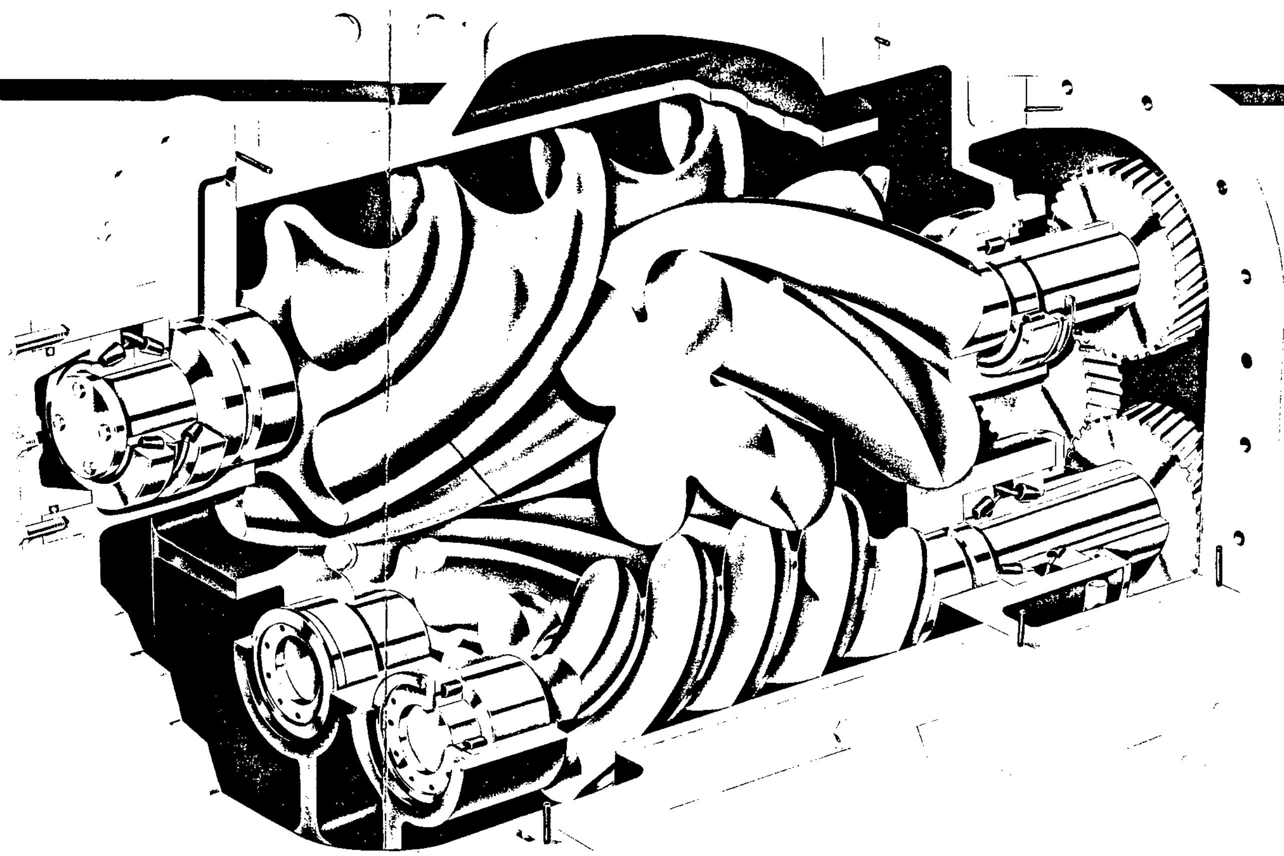
Consider what factors contribute to compressor operating expense: energy; water (if water cooled); replacement parts, coolants and lubricants, and labor costs. SSR 2-Stage compressors don't require water or consume a great deal of costly renewal parts. Compare the SSR 2-Stage's energy and installation costs, and maintenance expense to other compressors. You'll see that the SSR 2-Stage compressors offer the lowest total cost and can provide a rapid return on investment.

SSR 2-Stage Compression Ratios



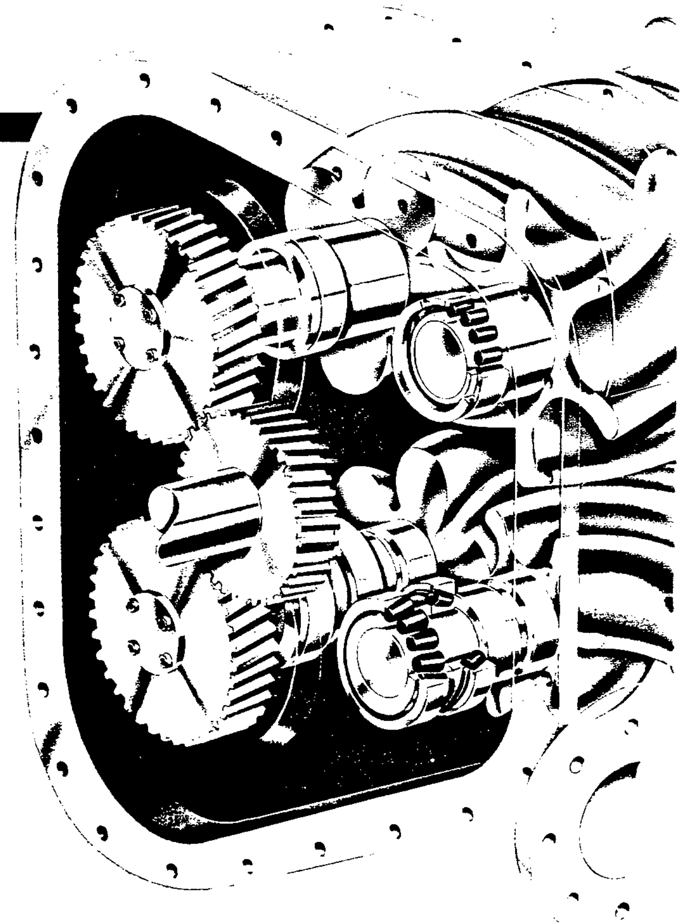
Many electric utilities have programs to reward companies who demonstrate energy conservation. Your electric utility may be supportive of demand side energy management efforts. Typically the utility will reward effective conservation efforts with incentives. You should contact your utility to see what programs exist. More than likely SSR 2-Stage compressors will qualify as new or replacement compressor energy conservation projects.

We challenged our engineers to design and deliver two stage efficiency with long term reliability and the typically low maintenance costs of Ingersoll-Rand single stage rotary compressors. The results exceeded our requirements, and the new two stage airend fits easily in our SSR market proven single stage, compressor package.



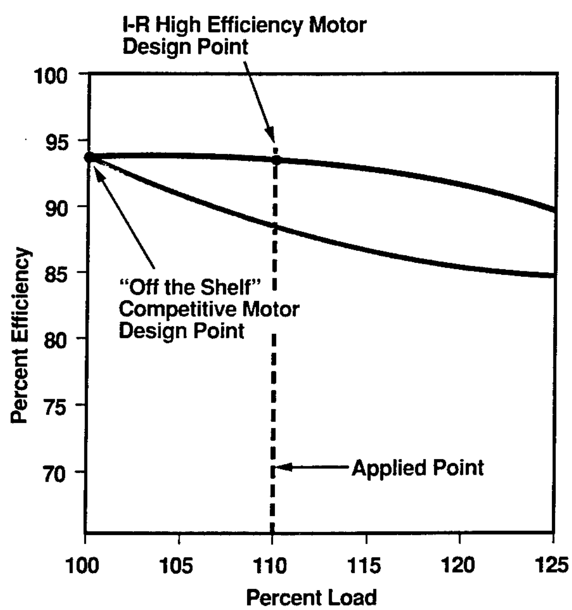
To achieve peak efficiency and because the two compression stages have different objectives our two stage, rotary screw airend uses different Ingersoll-Rand profile rotor sets. Our first stage rotors utilize a profile for high displacement and discharge at relatively low pressure. The second stage profile achieves high efficiency compression to final package pressure.

In addition to superior efficiency, we required reliability and long life as well. Both rotor sets use only the highest quality duplex tapered roller bearings. Duplex tapered roller bearing provide line contact to distribute the load equally over a larger area and dramatically extend the life of the airend. Our unique coolant dam traps coolant upon compressor shutdown, to assure proper bearing lubrication at startup and extended bearing life.



No other manufacturer has a drive train equal to ours, and nobody but Ingersoll-Rand offers a standard two year, unlimited hour warranty on drive train components. Our drive train includes a standard high efficiency motor, optimizing gears, and our two stage airend. Each component complements the other, giving you the most reliable, rugged, and simplest form of power transmission ever built, and a warranty that proves it.

SSR motors are designed both mechanically and electrically to be the perfect match for each compressor. We use only copper windings and class F insulation for greater reliability and increased motor life. Our motor is a dedicated compressor motor, designed for a 115° F (46°C) ambient, and the efficiency is rated at the full load, "point of use" horsepower.



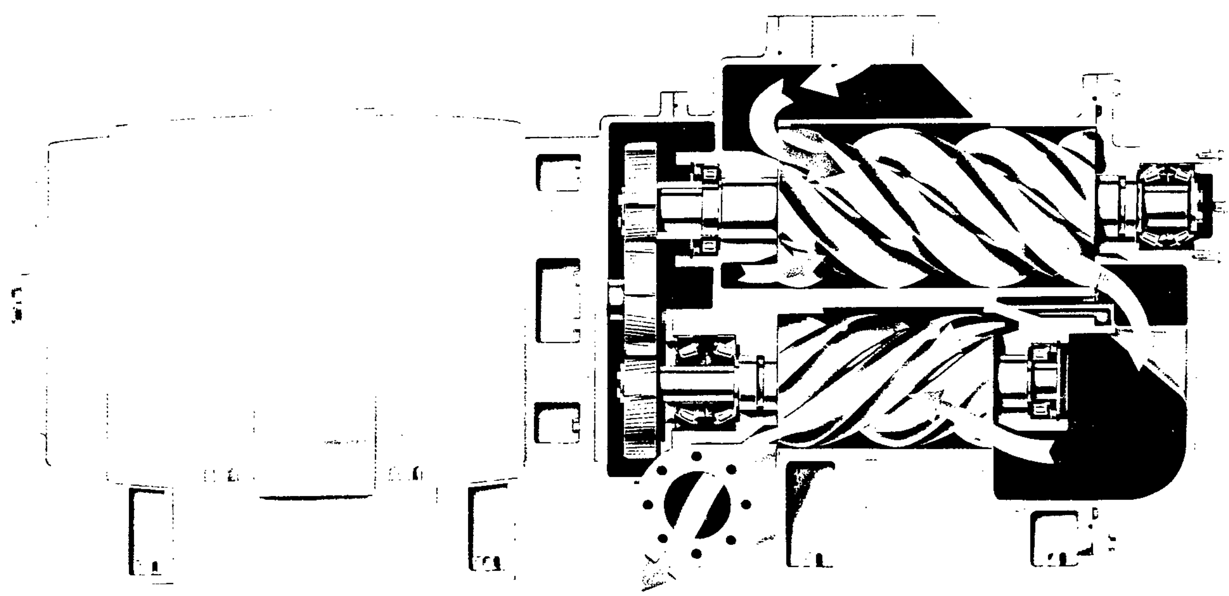
Integral gear drive is the most unique feature of our drive train. The drive gear (center) is mounted directly on the motor shaft, and the driven gears are mounted on the shafts of each male rotor. This eliminates maintenance prone and mis-aligned coupling or power robbing belts. The loads generated by the driven gears help offset the load on the drive gear further enhancing reliability and life. The drive is totally enclosed so that no dust or dirt can get in. Our exclusive seal and scavenge system prevents coolant from leaking into the motor.

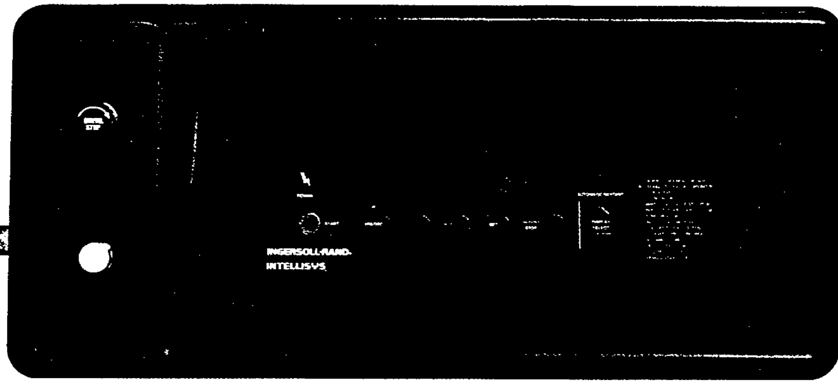
6

Air enters into the inlet of the first stage and is compressed as the male and female high displacement rotors rotate and mesh with each other. The first stage rotors discharge air through the coolant curtain located at the entry of the interstage area. Cooled air from the interstage enters the inlet of the second stage and is compressed by the high efficiency second stage male and female rotors. The compressed air now at desired system pressure passes through the second stage discharge port, and exits the two stage airend through the discharge flange.

To further enhance airend efficiency, coolant is injected into a channel at the first stage discharge port. A precisely machined liquid orifice in the channel creates a curtain of coolant in the interstage passage.

Air passes through the curtain on its way to the second stage, and through contact cooling, lowers the second stage inlet temperature. This patented process eliminates expensive non-contact cooling devices such as air or water-to-coolant heat exchangers.





The Ingersoll-Rand Intellisys® microprocessor controller makes operation of the SSR 2-Stage simple! All adjustments and display information are accessed through a finger-touch membrane panel, eliminating the need for tools and highly trained operating personnel.

The Intellisys monitors all compressor functions and displays information in plain language (not code) on a LED display.

- Off-line pressure
- On-line pressure
- Control mode selection
  - Intellisys Control, ACS
  - Modulation only
  - On-line/off-line
- Load/Unload delay time
- Star delta transition time
- Available as options
  - Remote start & stop
  - Auto start & stop
  - Auto start & stop shutdown time
  - Sequencer control
  - Power outage restart
  - Power outage restart time

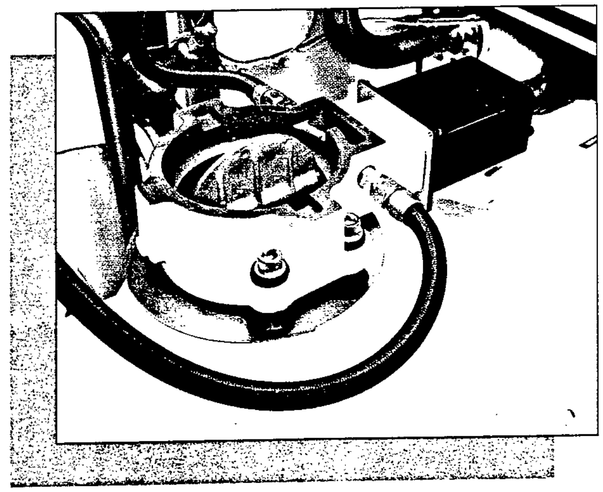
The Intellisys constantly monitors 12 prime compressor operating parameters. In the event any parameter deviates from its preprogrammed limit, Intellisys automatically warns and/or stops the compressor. The problem can then be displayed, saving costly troubleshooting expenses and minimizing downtime.

- Package discharge pressure
- Airend discharge temperature
- Injection coolant temperature
- Sump pressure
- Inlet filter condition
- Coolant filter condition
- Separator element condition
- Total hours/loaded hours

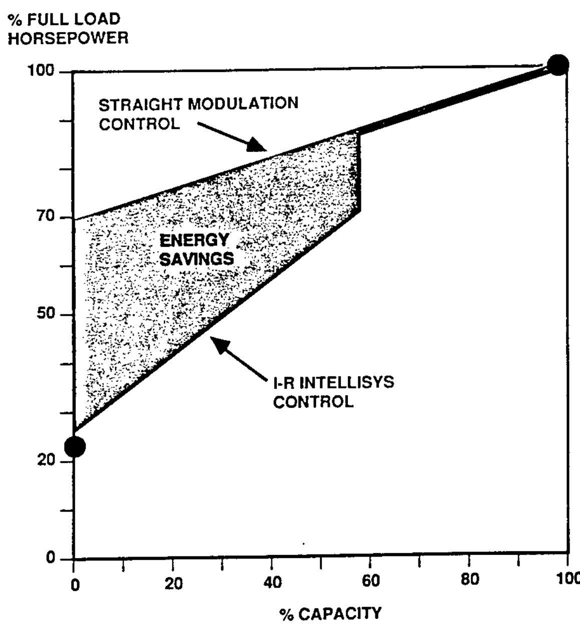
- Change inlet filter
- Change coolant filter
- Change separator element
- High airend discharge temperature

- High airend discharge temperature
- High sump pressure
- Low unloaded sump pressure
- Low loaded sump pressure
- Starter fault
- Low inlet vacuum
- Main motor overload
- Fan motor overload
- Reverse rotation
- Pressure transducer failure
- Temperature sensor failure

The Intellisys microprocessor controls Ingersoll-Rand's innovative stepper motor inlet-control for precise inlet throttling to match system requirements. This advanced control system automatically throttles the compressor to match pressure to load through our exclusive stepper motor. That means no more manual recalibrating to correct pressure drift every few months—it's now done simply and accurately through the Intellisys control panel.



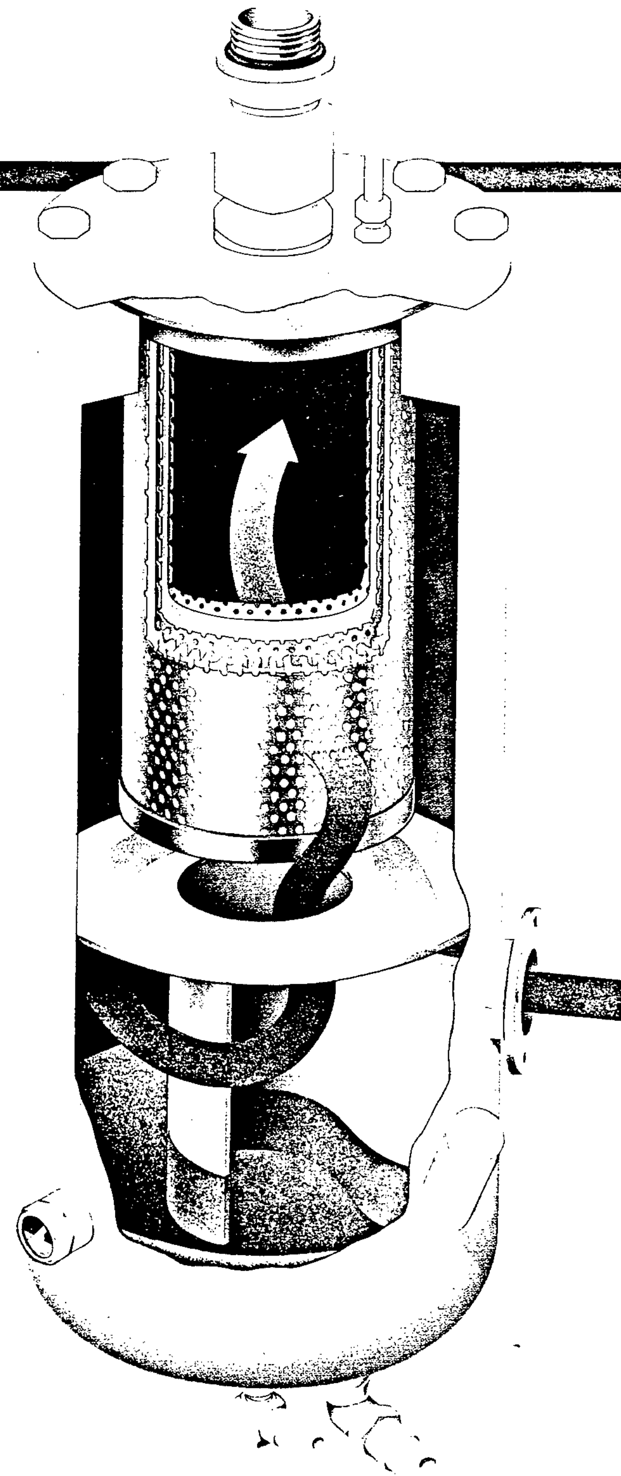
For the first time, you have an automated air compressor-based system for efficient, real time energy management. The Intellisys ACS (Auto Control Selector) control operates the compressor in on-line, off-line during low demand periods (0-60% capacity), or in upper range modulation during medium to high demand periods (60-100% capacity).

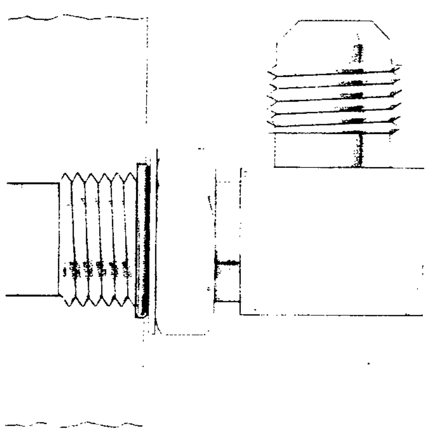


Intellisys Control saves up to an additional 16% in energy cost when compared to straight modulation control

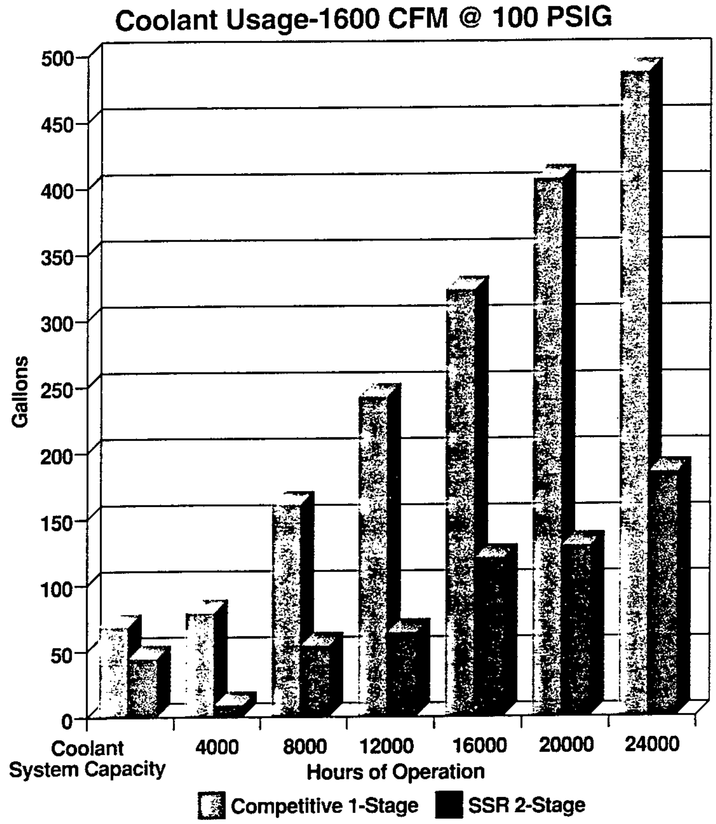
Realizing pressure is a function of volume, the Intellisys controller continuously monitors pressure and its rate of decay or increase. Intellisys automatically selects the operating mode which best fulfills the system's need for compressed air, all the while operating the compressor in its most efficient mode.

The SSR air-coolant two-stage separator system has a truly unique and innovative design. A baffle, located in the separation sump tank, performs first stage mechanical separation. The second stage separator element resides above another baffle which creates a dry sump. This two stage separation system limits carry-over to less than 2 ppm downstream of the package discharge.





Ingersoll-Rand has cut the number of fittings, pipes and hoses in the SSR by 40% to reduce potential leakage problems. To further reduce potential leak problems associated with conventional threaded connections, Ingersoll-Rand's SSR compressors use SAE "O" Ring fittings on connections larger than 1/4" in diameter. These fittings are designed to provide improved installations and connections. SAE "O" rings are the preferred fittings for most hydraulic applications.



All SSR's are factory-filled with our exclusive Ultra Coolant, a polyglycol synthetic compressor coolant. Ultra Coolant is so advanced that it only requires changing every 8,000 hours or two years under normal operating conditions. Using the lubrication system's inherent sump pressure, a positive flow of Ultra Coolant simultaneously lubricates, cools, and seals the rotor chambers during all operating conditions. Ultra Coolant offers superior separation for lower coolant make-up, and will not form varnish or sludge under any circumstances.

Ingersoll-Rand is concerned about the environment and designed this compressor accordingly. The combination of SSR Ultra Coolant and our unique separator design respect the environment by significantly reducing coolant usage.

Separated coolant circulates throughout the system so efficiently, the SSR 2-Stage compressor's coolant capacity is up to 35% less than other compressors. Coupled with our 8,000 hour coolant life and less coolant to begin with, you can dramatically reduce coolant and disposal costs.

SSR Package Design

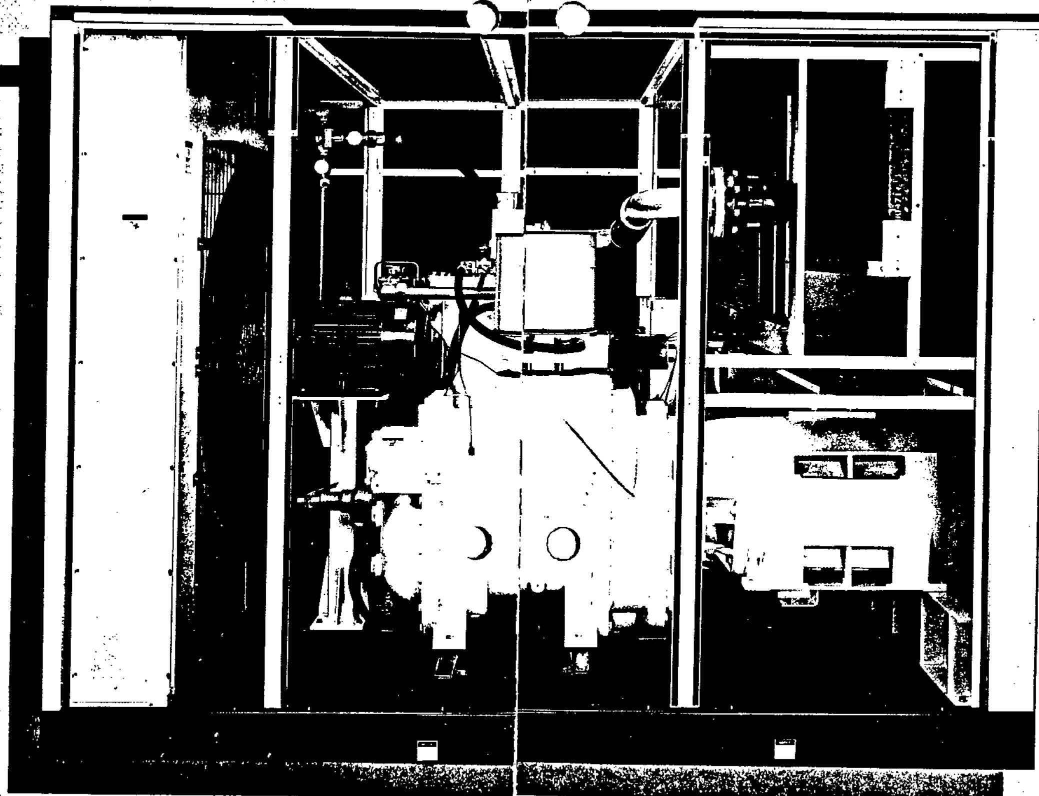
The Ingersoll-Rand SSR Rotary Compressor's totally integrated package was designed to combine smoother, quieter operation with greater servicing convenience. It's the easiest rotary screw compressor to operate because of these key features:

Quieter Operation A subassembly isolates the drive train from the package for virtually vibration free operation. This results in a much quieter compressor with sound levels as low as 80 dbA (according to CAGI/Pneurop standards).

Superb Serviceability Routine maintenance is done through convenient latched panels on the package.

Superior Package Appearance The enclosure is fabricated from sheet metal and is finished with a superior high quality durable finish of baked on textured paint. Anodized and plated or coated pipes and fittings provide excellent corrosion resistance.

End-to-End Cooling The aftercooler is located at the inlet end of the package. This means cool compressed air, only 15°F (8°C) above ambient air temperature, discharges from the package.



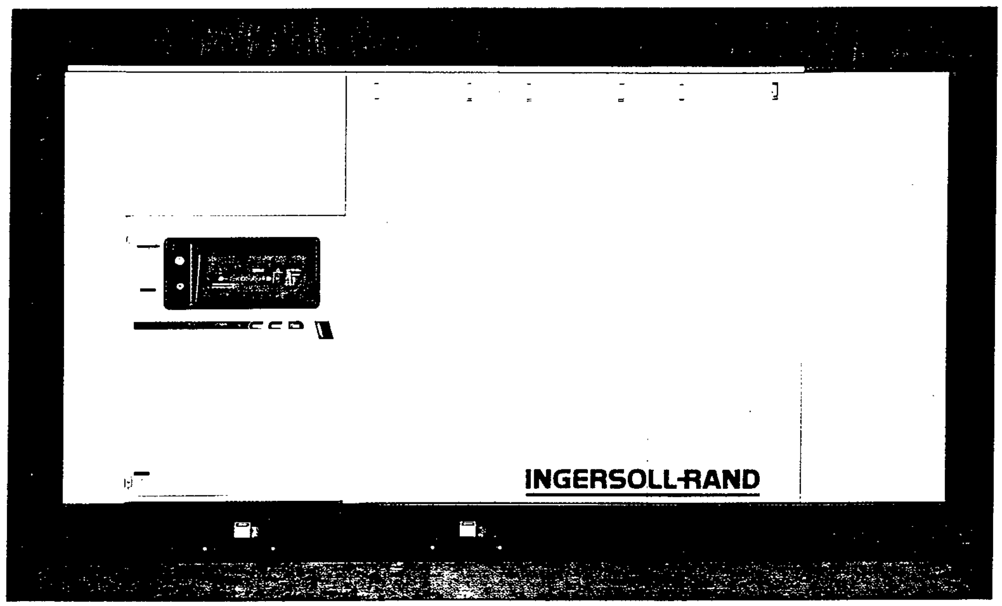
Single-point Connections The SSR is fully piped and wired, resulting in simple external connection of all utilities.

Spin On Coolant Filter The SSR incorporates a spin-on coolant filter for easier removal and replacement.

Higher Ambient Operating Temperatures The SSR is designed to run efficiently in 115°F (46°C) ambients. During hot summer months disruptive high temperature shutdowns are avoided.

Star Delta Starter Standard, and integrally mounted on all 250-350 horsepower 460V and 575V models. 400 and 450 horsepower, 460V and 575V models are supplied with remote starters.

Convenient Top Exhaust The cooling air flow discharges from the top of the package to facilitate easier ducting of waste heat for removal or recovery.



The SSR's Intellisys Controller has four optional software programs to customize your compressor operations:

Auto Start/Stop allows you to program the automatic starting, stopping, and restarting of the compressor.

Remote Start/Stop gives you offsite on/off control when the compressor is operating.

Modulation Percentage of Load enables you to monitor the percent of full load air flow the compressor is producing.

Power Outage Restart allows you to have your air compressor automatically restart after incoming power is restored if a power failure occurs.

- Water-cooled
- 2300V and 4160V Models
- 50 Hertz Models
- 380/3/60 Models
- TEFC Motor
- Premium Efficiency ODP & TEFC Motors
- Starter Elimination
- Aftercooler Elimination
- Sequence Control
- NEMA 4
- Outdoor Modification
- Low Ambient Modification
- Phase Monitor
- High Dust Filter

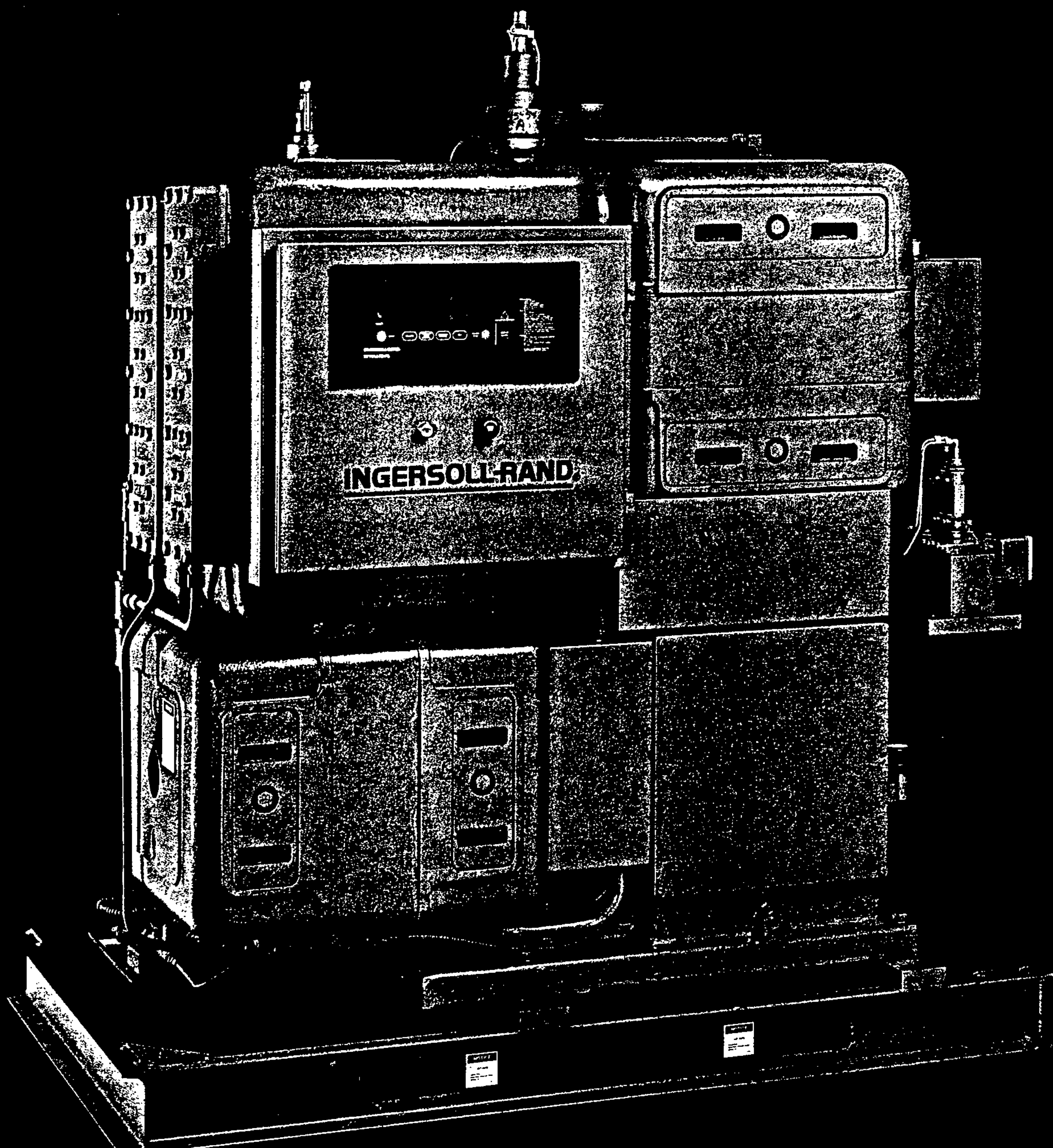
SSR Specifications (60 Hertz)

Model	HP	FAD*	Maximum Modulation Pressure	Full Load Pressure	Length	Width	Height	Weight
SSR XFE250-2S	250	1355	110	100	148 in.	76 in.	85 in.	13,080 lbs.
SSR EPE250-2S	250	1213	135	125	148 in.	76 in.	85 in.	13,080 lbs.
SSR HPE250-2S	250	1154	150	140	148 in.	76 in.	85 in.	13,080 lbs.
SSR HXPE250-2S	250	868	210	200	148 in.	76 in.	85 in.	13,080 lbs.
SSR XFE300-2S	300	1602	110	100	148 in.	76 in.	85 in.	13080 lbs.
SSR EPE300-2S	300	1436	135	125	148 in.	76 in.	85 in.	13080 lbs.
SSR HPE300-2S	300	1362	150	140	148 in.	76 in.	85 in.	13080 lbs.
SSR HXPE300-2S	300	1047	210	200	148 in.	76 in.	85 in.	13080 lbs.
SSR XFE350-2S	350	1866	110	100	160 in.	82 in.	96 in.	14865 lbs.
SSR EPE350-2S	350	1674	135	125	160 in.	82 in.	96 in.	14865 lbs.
SSR HPE350-2S	350	1595	150	140	160 in.	82 in.	96 in.	14865 lbs.
SSR HXPE350-2S	350	1230	210	200	160 in.	82 in.	96 in.	14865 lbs.
SSR XFE400-2S	400	2096	110	100	160 in.	82 in.	96 in.	14865 lbs.
SSR EPE400-2S	400	1886	135	125	160 in.	82 in.	96 in.	14865 lbs.
SSR HPE400-2S	400	1798	150	140	160 in.	82 in.	96 in.	14865 lbs.
SSR HXPE400-2S	400	1405	210	200	160 in.	82 in.	96 in.	14865 lbs.
SSR XFE450-2S	450	2310	110	100	160 in.	82 in.	96 in.	14865 lbs.
SSR EPE450-2S	450	2093	135	125	160 in.	82 in.	96 in.	14865 lbs.
SSR HPE450-2S	450	2002	150	140	160 in.	82 in.	96 in.	14865 lbs.
SSR HXPE450-2S	450	1578	210	200	160 in.	82 in.	96 in.	14865 lbs.

*FAD (Free Air Delivery) = Total Package CFM at the rated full load pressure, delivered at the customer connection, inclusive of all losses, and related back to inlet conditions.

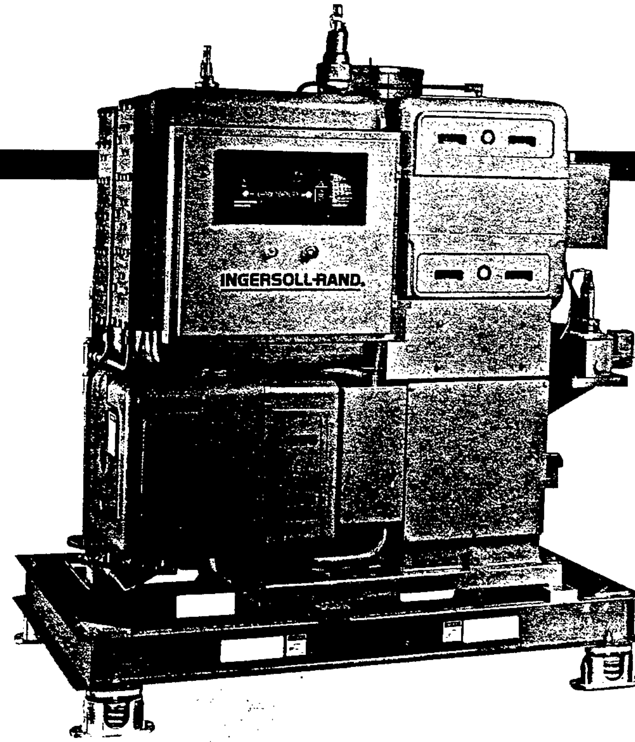
Note: Physical dimensions and weights vary with certain options. Consult your Sales Representative for specifics.

LLE Reciprocating Air Compressor

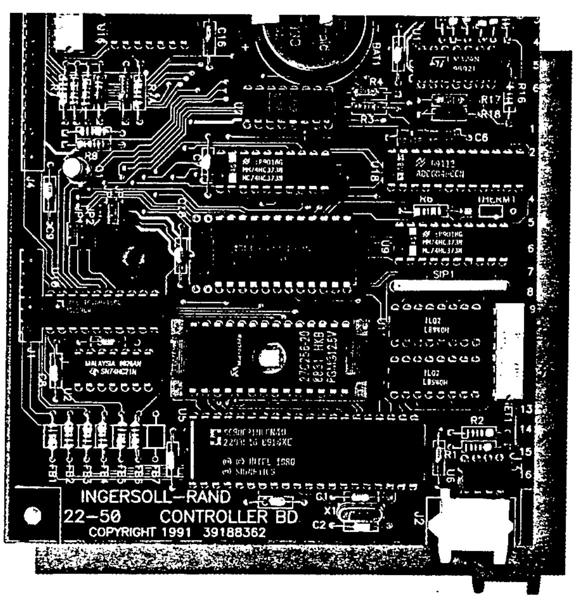


INGERSOLL-RAND®
AIR COMPRESSORS

The first compressor ever designed was a Reciprocating Compressor. In the many years since its invention, the technology has greatly improved. Today, Reciprocating compressors provide the highest efficiency of any current compression technique. Additionally, this experience has perfected the mechanical aspects of the design to produce the longest life possible.

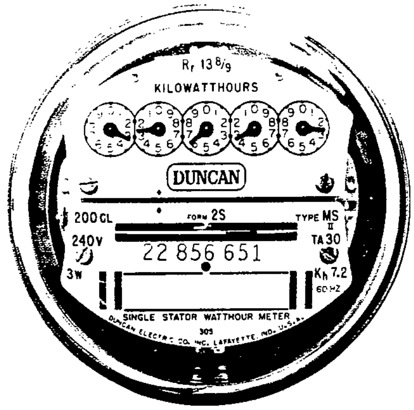


Since its introduction the LLE has grown in reputation as an innovative, reliable and exceptionally efficient air compressor. The LLE's design is based on the reciprocating compression principle, which is the most efficient and dependable method of air compression yet devised. Over 6,000 varied installations, in all types of environments, testify to the LLE's ruggedness - a ruggedness that allows the LLE to prevail under harsh operating environments that frequently stop ordinary compressors.



Ingersoll-Rand pioneered the application of advanced microprocessor based controls for compressors, with the Intellisys® family of intelligent controls. The Intellisys® is the most ingenious and innovative control system on any air compressor. Installed on the LLE, it makes the compressor virtually self-sufficient.

Thousands of Ingersoll-Rand Intellisys® controlled compressors already at work around the world attest to the reliability and dependability of this unique microprocessor control. Also, since all Intellisys® share a common heritage and design philosophy, continuity is assured.



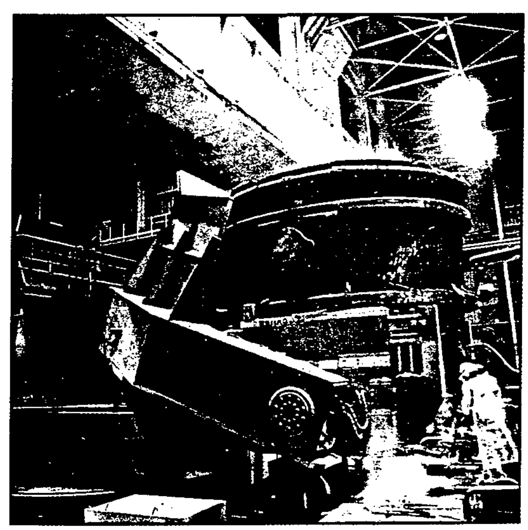
The best measure of compressor efficiency is the kilowatts required to compress the air. With the LLE, superior efficiency results from an inherently efficient design, superbly executed.

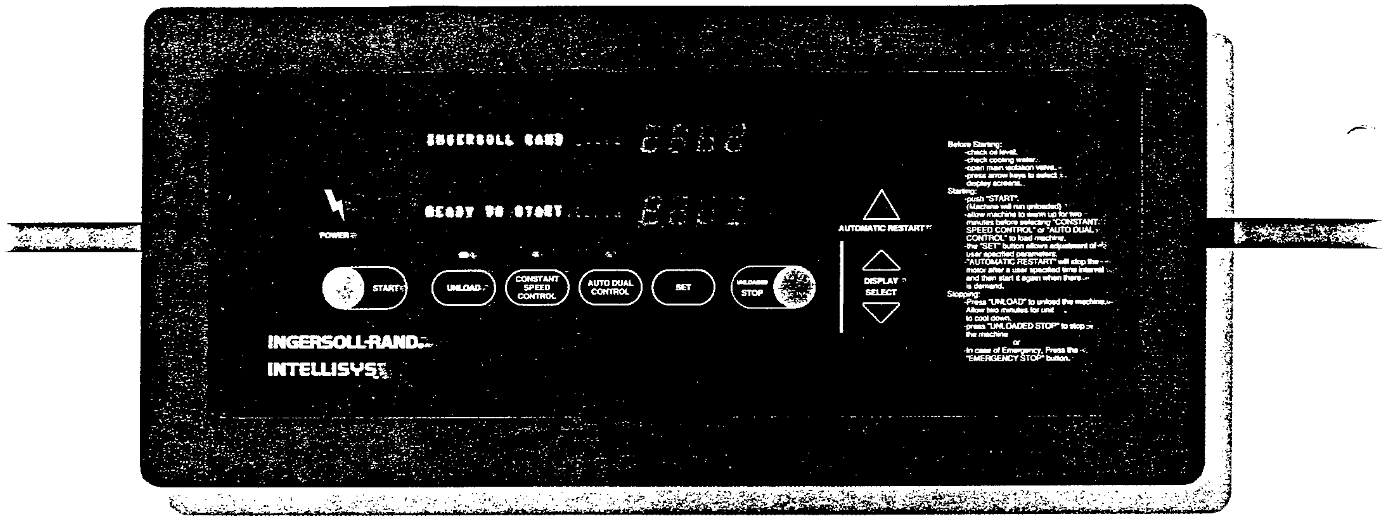
At full load output, the LLE is commonly as much as 15% more efficient than screw compressors. At reduced output levels, its efficiency advantage gets even better due to the microprocessor-based multi-step control system. Energy savings continue even when the compressor is running at "no load" because the no-load horsepower is typically less than half that of other types of compressors. This single benefit, the inherent ongoing energy savings, is justification enough for many customers to purchase the LLE compressor.

Unfortunately, not all compressor installation environments are as clean and well ventilated as the installation manual recommends. If there is no choice but to site a compressor in a less than ideal environment, then special attention to specify the right compressor is mandatory.

The extremely rugged LLE is frequently the compressor of choice in these instances. Its heavy duty, water-cooled construction and forgiving nature make it ideal for reliable operation in extraordinary applications.

Ordinary air compressors are designed for ordinary installation requirements. If you put an ordinary compressor in an extraordinary application, trouble is usually not far behind. Fortunately, the Ingersoll-Rand LLE is not an ordinary compressor, which makes it the ideal solution for your extraordinary needs.





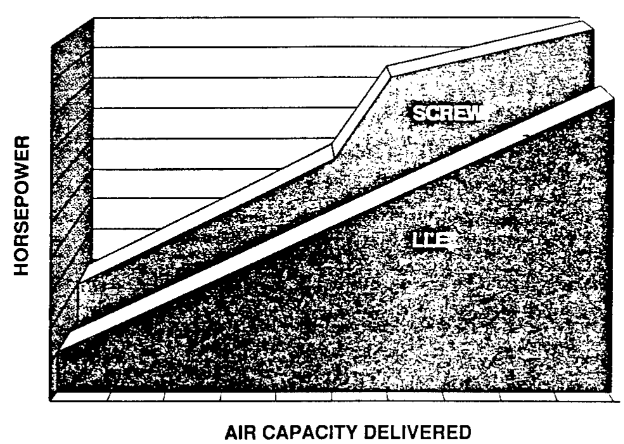
The Intellisys® is an Ingersoll-Rand designed and built electronic, microprocessor based controller. Every quarter of a second, it monitors, within 1% accuracy, all system parameters as well as the compressor's condition. This virtual real-time accurate monitoring allows the compressor to be operated with total assurance.

The Intellisys® comes factory tested and preset for normal operation. All monitored pressures and temperatures have adjustable alarm points and most monitored functions have both a warning and shutdown mode. However, if site adjustments to the compressor control system are desired to make it a perfect fit, the Intellisys® can be adjusted from the membrane panel. Since mechanical control adjustments on the compressor have been eliminated, special tools and highly trained operating personnel are no longer required. In addition, the adjusted value is exactly what is displayed on the Intellisys® within 1%.

The LLE will warn you when a programmed limit is being approached and it will shutdown if the limit is exceeded. The Intellisys® utilizes first-out annunciation to detail the sequence of events.

The LLE is the most efficient plant air compressor available. When the air demand drops, the control systems come into play delivering an even more impressive efficiency. The Intellisys® equipped LLE offers Constant Speed Control and Auto-Dual Control as standard. Constant Speed Control will operate the compressor fully loaded, partially loaded and unloaded depending on system demand.

Auto-Dual Control is Constant Speed Control with the added feature of automatically stopping the compressor if it runs unloaded for a user specified time interval. This control system provides the highest attainable partial load efficiency, giving you significant cost savings.



When evaluating which air compressor to purchase, remember that what you are really buying is compressed air. Therefore, it is important to consider all the costs involved in producing compressed air.

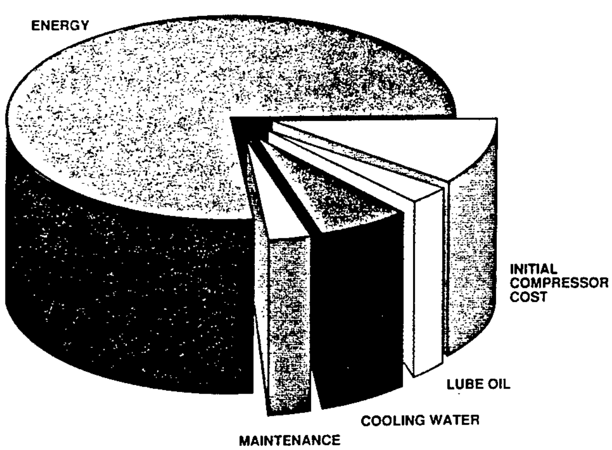
These costs include:

- Initial Compressor Cost
- Compressor Installation Cost
- Cooling Water Cost (if required)
- Compressor Maintenance Costs
- Energy Costs

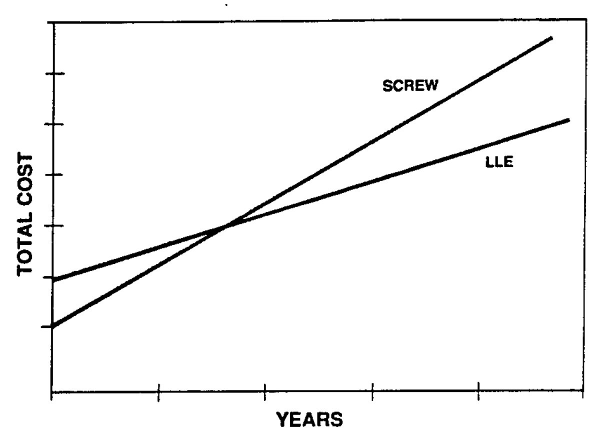
Putting these costs in perspective, the yearly energy costs will far outweigh all other compressed air costs.

Over the total life of an LLE all costs other than energy are insignificant, including the compressor purchase price.

LLE 5 YEAR TOTAL OPERATING COST



Consider the total life cycle cost of supplying 800 cubic feet per minute of air at 110 psig for five years. Comparing an LLE and a lubricated rotary screw, the LLE will cost more initially but its superior operating efficiency greatly reduces energy consumption. In fact, the initial cost is typically made up in less than two years of operation. Over five years of operation the LLE will be significantly more economical.



In order to help intelligently evaluate the various air compressor choices, Ingersoll-Rand has developed a computerized evaluation program which takes all the relevant factors into consideration. Contact your local Ingersoll-Rand representative for a no cost, no obligation evaluation of compressor choices specific to your situation.

Technically, an LLE can be described as a crosshead-type, double-acting, water-cooled, packaged, reciprocating compressor. While accurate, this description does not adequately convey the remarkable durability inherent in every LLE. This is a machine intended to be run hard for long periods without interruption.

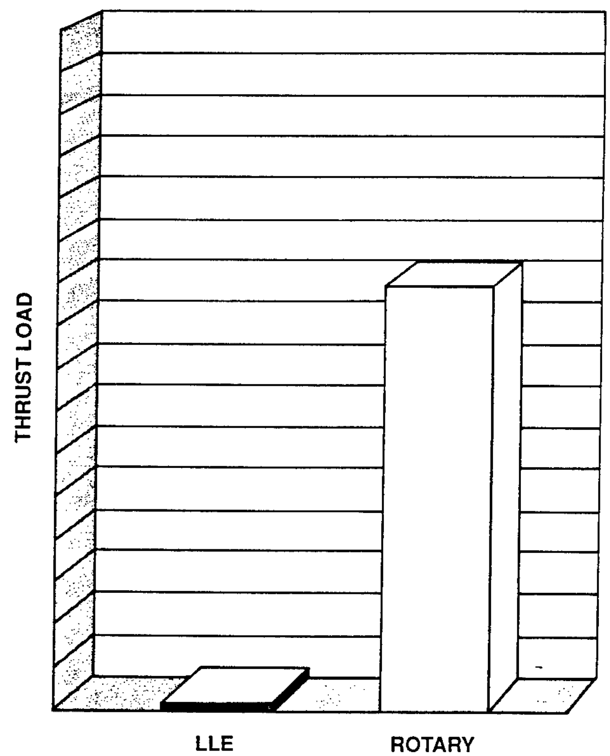
The basic design philosophy of the LLE is responsible for this longevity. For example, the compressor runs at a fraction of the rotative speed commonly seen today with other compressor designs.

Further, the lubrication system automatically and continuously provides metered amounts of fresh lubricant to the compression chambers. This lubrication technique continuously "flushes" the cylinders, assuring reliable performance. No recirculation of compression lubricant is permitted, by design, in the LLE.

One of the principle causes of compressor breakdown on rotary compressor designs is failure of the thrust bearings. This is due to the high axial thrust component inherent in the design of these machines.

The LLE essentially eliminates thrust load within the machine, resulting in much longer life for the bearing system. The main bearings in an LLE have a design life in excess of 30 years and experience to date validates this expectation.

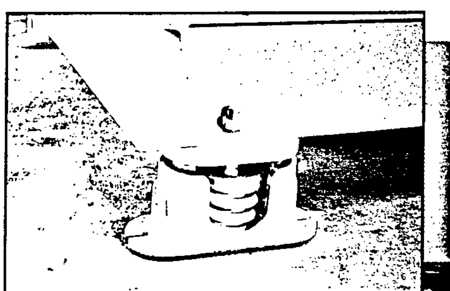
When durability and reliability are required the LLE is the compressor of choice.

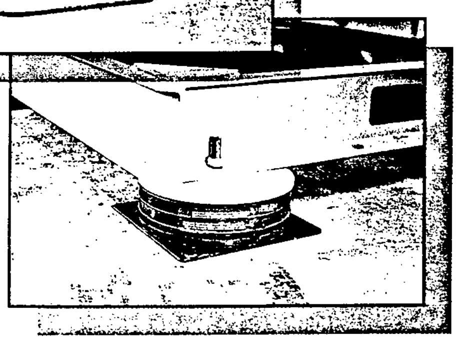


The LLE comes completely factory assembled, tested and ready to run. Everything is built-in, not added on, including the intercooler, aftercooler (if purchased), flange-mounted motor, Intellysis controller, inlet filter and starter (if purchased). Due to the LLE's low inertial loads, it can be mounted on vibration isolators to further simplify installation. With a 6 to 8 inch reinforced concrete floor a foundation is normally not needed. The LLE package is so efficiently designed that it takes up as much as 50% less floor space than a rotary screw. The following are all the site connections that are required:

- Power to starter
- Air discharge
- Condensate
- Water in and out

Spring Mount





Rubber Mount

Compressor servicing has not been overlooked in the LLE design, either. Many features have been integrated to make necessary service quick and easy.

The LLE is like no other reciprocating compressor ever designed. These unique features minimizes routine maintenance and simplify what little effort is required.

- Routine maintenance consists of oil, filters and minor inspections.
- 3 - 5 year valve life is not uncommon when synthetic lubricants are used.
- Removable tube bundles with 5/8 inch straight tubes makes cooler cleaning easy.
- Lubricator oil reservoir (optional) and Ren valve allows days between refills.
- All maintenance can be accomplished by your staff.
- Single-bolt valve covers greatly simplify valve inspection and/or maintenance.
- Water-cooled cylinders and synthetic lubricants greatly extend ring life.
- Intellisys® extensive monitoring allows for easy trending, making maintenance predictable.
- Water-cooled packing casings extend packing life.
- Built-in pulsation chambers greatly increase valve life.
- No mechanical adjustments, all components precision machined to exact tolerances, simply fit pieces together.

The Intercooler and optional aftercooler are compact, water-in-the-tubes, removable bundle heat exchangers which provide high efficiency. Air flow between cylinders and cooler sections is completely internal, minimizing pressure drops and eliminating piping strain on cylinders. The coolers include solenoid valve condensate traps for trouble free operation.

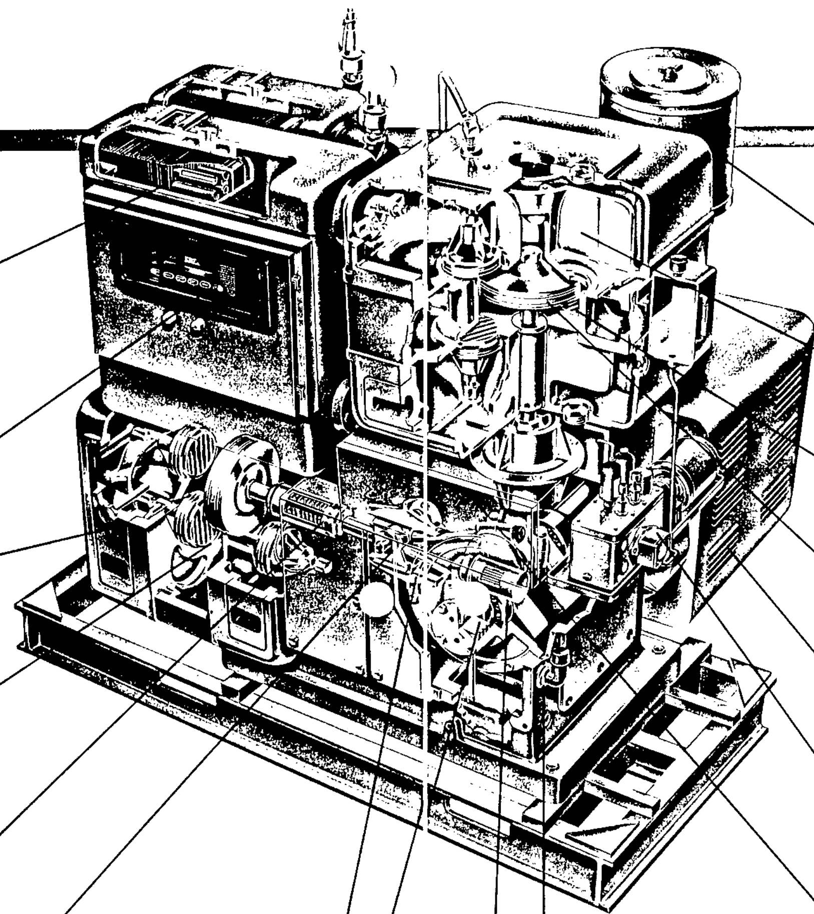
Control for the LLE is provided by the integral Intellisys® Controller - the most advanced and easy-to-use Microcontroller in the industry today.

Remove a valve in seconds for easy inspection and maintenance with the LLE's unique single-bolt design. There are only four valve covers to a cylinder, and once inside you can remove a valve by loosening just one more bolt.

Ingersoll-Rand's unique channel valve design is one of the key reasons for the LLE's longevity. These special air-cushioned valves float rather than slam against their stops. The channel design also provides the quickest and easiest maintenance of any inlet/discharge valve.

Self-adjusting, metallic-packing and oil wiper rings prevent air leakage and the loss of crankcase oil along the rods. The packing/wiper rings have integral wear stops to prevent scoring of piston rods and are assembled in a single cartridge for easy maintenance.

The crosshead is a one-piece, shoeless design utilizing hydrodynamic principles to eliminate any metal to metal contact which results in low parasitic losses and virtually infinite life.



Cylindrical, full-bored crosshead guides are designed for the life of the compressor with permanent alignment requiring no shims or adjustments.

A shaft-driven pump delivers pressurized, filtered oil to all bearings through internal passages. The large oil reservoir enables the LLE to run for months.

The LLE's sealed and gasketed frame protects all moving parts, including piston rods, from dust, dirt and water. The compact design saves space.

The crankshaft is mounted in heavy duty, self-aligning, spherical roller bearings with a design life of over 30 years of continuous duty operation.

This specially designed sound suppressing, weatherproof filter comes factory mounted with a replaceable dry-type element. An efficiency gauge signals the need for filter element service.

The large air passages in each cylinder head are computer designed to minimize air pulsations which greatly increases valve life.

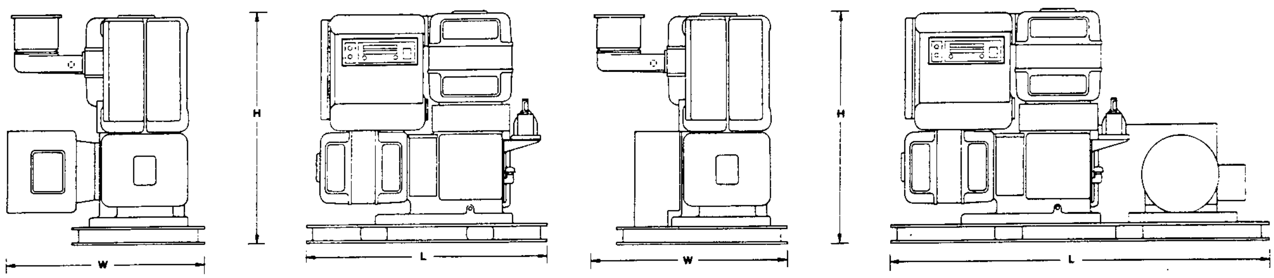
The heads and cylinder barrels are water-jacketed to insure the lowest possible operating temperature. This greatly reduces wear and enhances life.

High-strength, low-mass wafer pistons result in low inertial loads and unbalanced forces, so little or no foundation is required.

The LLE comes standard with a flange mounted motor directly connected to the crankshaft. As an option, direct connected and v-belt drives are available.

Force-feed lubrication to the cylinders is provided by a separate motor driven, compressor mounted, lubricator. An optional oil reservoir with fill valve can be supplied to extend fill-up intervals.

A rugged, large diameter, forged steel, rigid crankshaft insures maximum stability and long life. Specifically designed integral counter weights provide for smooth operation and require no maintenance.



FLANGE-MOUNTED DRIVE V-BELT DRIVE

Model	Motor HP	Capacity ACFM 100 Psig	Dimensions with Flange-Mounted Drive L	W	H	Dimensions with V-Belt Drive L	W	H	Approximate Weight Pounds
LL2	75	400	6'0"	5'0"	6'2"	8'7"	5'2"	6'2"	7800
	100	505	—	—	—	8'7"	5'2"	6'2"	7900
	125	570	6'0"	5'0"	6'2"	8'7"	5'2"	6'2"	8000
LL3	100	535	6'0"	5'0"	6'2"	8'7"	5'2"	6'2"	7900
	125	635	—	—	—	8'7"	5'2"	6'2"	8000
	150	715	6'0"	5'0"	6'2"	8'7"	5'2"	6'2"	8100
LL5	125	634	6'4"	5'2"	6'4"	8'11"	5'4"	6'4"	9500
	150	810	6'4"	5'2"	6'4"	8'11"	5'4"	6'4"	9600
	200	955	—	—	—	8'11"	5'4"	6'4"	9700

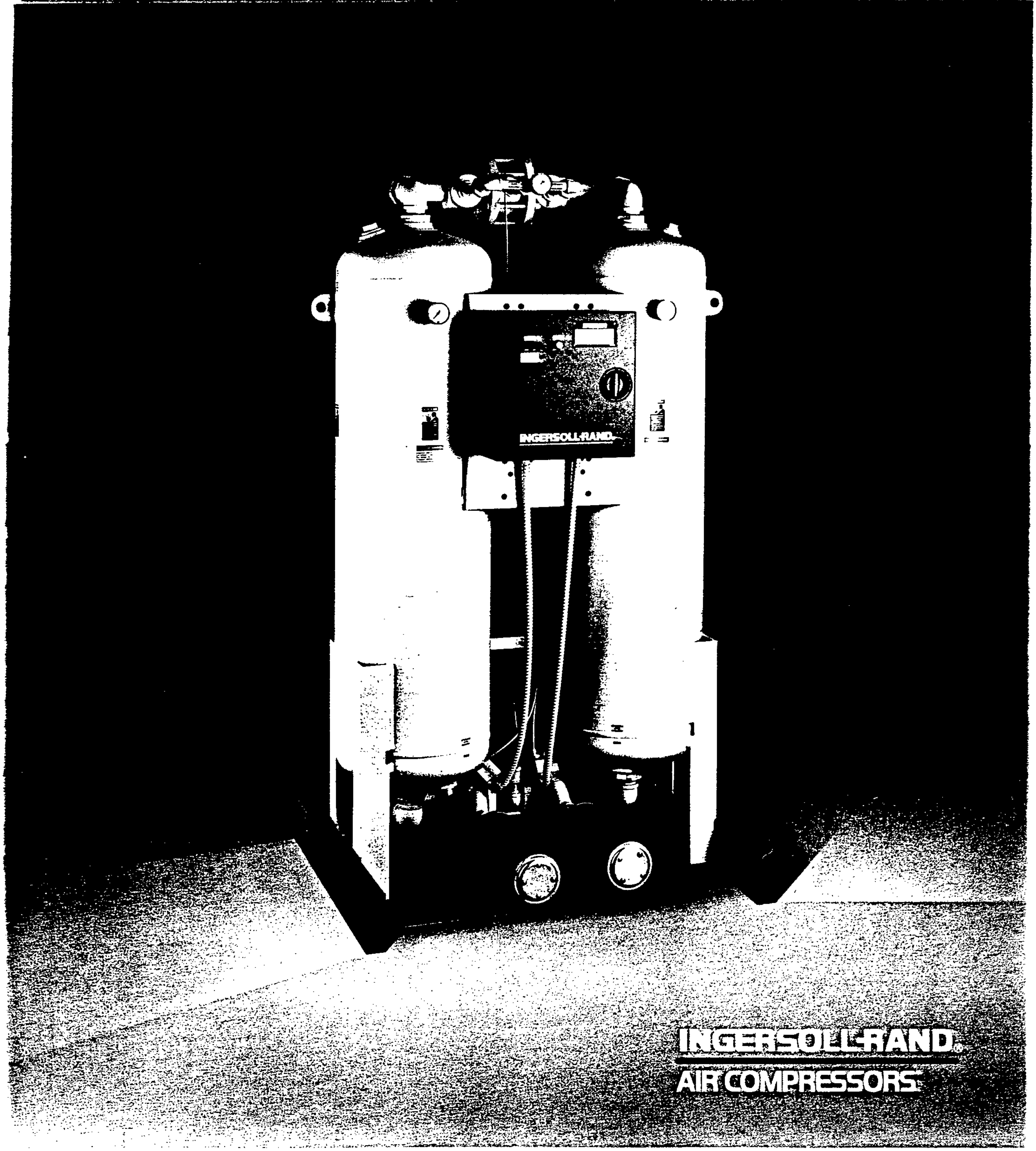
Ingersoll-Rand Company is in its second century of service to the world's industries. Starting with Simon Ingersoll's first invention in 1871, Ingersoll-Rand has been developing innovative solutions to serve the ever-changing needs of industries. In the years since, we've grown into a multi-billion dollar company with manufacturing and sales operations throughout the world. In addition to all types of air compressors, we manufacture a wide variety of industrial machinery and equipment for many markets that have one thing in common - Ingersoll-Rand's commitment to innovation and quality.

Ingersoll-Rand and our Distributors all around the world stand ready to provide a variety of creative solutions to your needs for compressed air.

There are Ingersoll-Rand manufacturing facilities, offices or distributors in over 130 countries around the globe, each with experienced and knowledgeable people. You can depend on getting practical application assistance and prompt maintenance repair or spare parts no matter when or where they are needed.

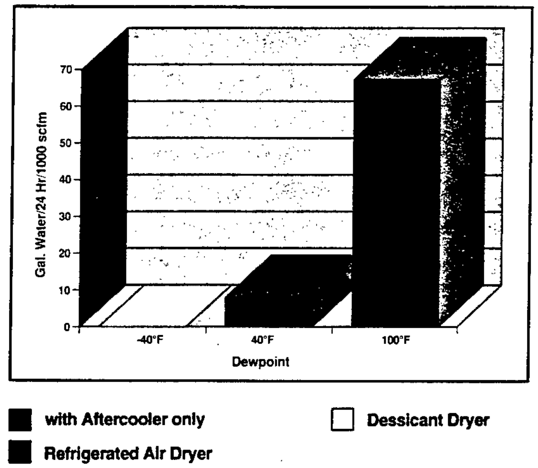
No company in the world has more experience in the design and manufacture of air compressors than Ingersoll-Rand. With an LLE you are investing in not just a machine, but a world-wide reputation for quality and reliability. This is peace of mind that comes from dealing with the world's most experienced compressor manufacturer.

Heatless Regenerative Dryer HRD Series



In today's demanding process, instrumentation and high tech manufacturing environments, clean and dry compressed air is mandatory for optimum results. Water and water vapor, lubricants, rust and dirt must be completely removed from the compressed air. Failure to remove them frequently results in product spoilage, downtime and increased costs of operation.

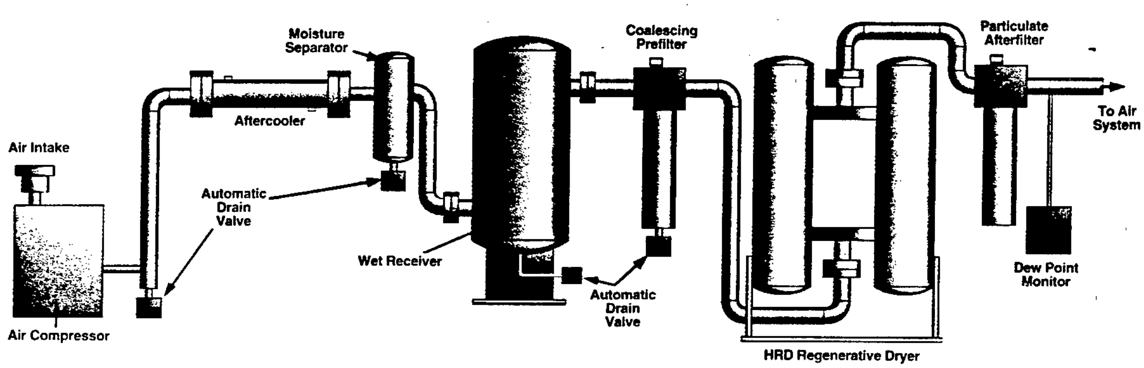
Moisture Content of Compressed Air



To remove water or water vapor, some type of dryer is required, to reduce the "dewpoint" of the compressed air. The two most common types used today are the Refrigerated and Desiccant dryers. Refrigerated Air Dryers can reduce the dewpoint of compressed air to only 33°-39°F (1 °-4°C), as condensed water turns to ice at lower temperatures, causing ice blockages and air flow stoppage. For dewpoints down to -40°F (-40°C) or lower, a Desiccant dryer is clearly the preferred solution, because its' "adsorption" principle works on water vapor only.

Types Of Desiccant Dryers

Desiccant Dryers are available in two basic variations, Heatless and Heated. Both types utilize dual pressure vessels, along with appropriate valving and automatic controls, to switch between the active and the regenerating vessel. One vessel is actively drying the compressed air while the other vessel is being regenerated. The two vessels switch back and forth, with the regenerated vessel becoming the active vessel, as the other vessel regenerates.



While both types of Desiccant Dryers each have advantages and limitations, the Heatless type is the most popular, due to its' inherent advantages of high reliability and low maintenance.

The desiccants used in HRD dryers have been selected basis our twenty five plus years of experience in the design and manufacturing of Desiccant Dryers. The vessels have been designed specifically for this service. Vessel diameters have been chosen to allow a minimum of five (5) seconds contact time, which is essential for complete moisture adsorption and consistent dewpoints. Air velocity through the dryer has been conservatively designed at less than sixty-five feet per minute, minimizing desiccant fluidization and dusting, and resulting in high dryer reliability.

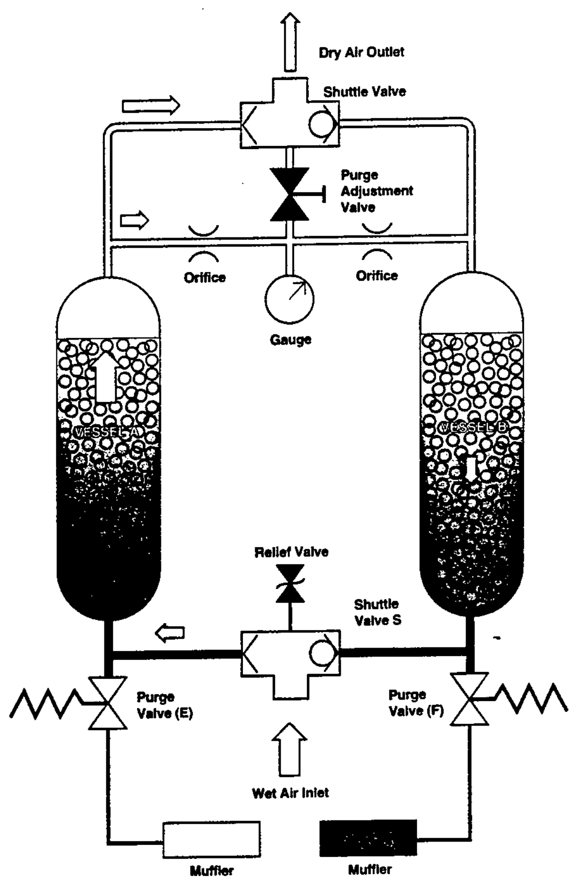
Ingersoll-Rand's HRD heatless desiccant dryers are designed to produce a consistent -40°F (-40°C) dewpoint compressed air.

Optional HRD dryers for -100°F (-73°C) are also available.

Saturated compressed air enters the dryer at the inlet valve and into the bottom of the active vessel. Moisture is absorbed by the desiccant as the air flows upward through the vessel. Dry compressed air exits at the outlet valve, dried to the design dewpoint rating.

A portion of the dry air is diverted, and metered through the purge adjusting valve, through the vessel being regenerated, drying the wetted desiccant and preparing it for reuse. This purge air is exhausted through the purge exhaust valve and the silencer, having served its' purpose.

In the fixed cycle mode, each vessel operates for approximately four minutes before switching. This vessel switching procedure is repeated again and again, assuring a continuous flow of dry air from the unit.



The Ingersoll-Rand HRD series desiccant dryer line has a very comprehensive array of standard features to give you high reliability, easy operation and minimal maintenance. Standard features include:

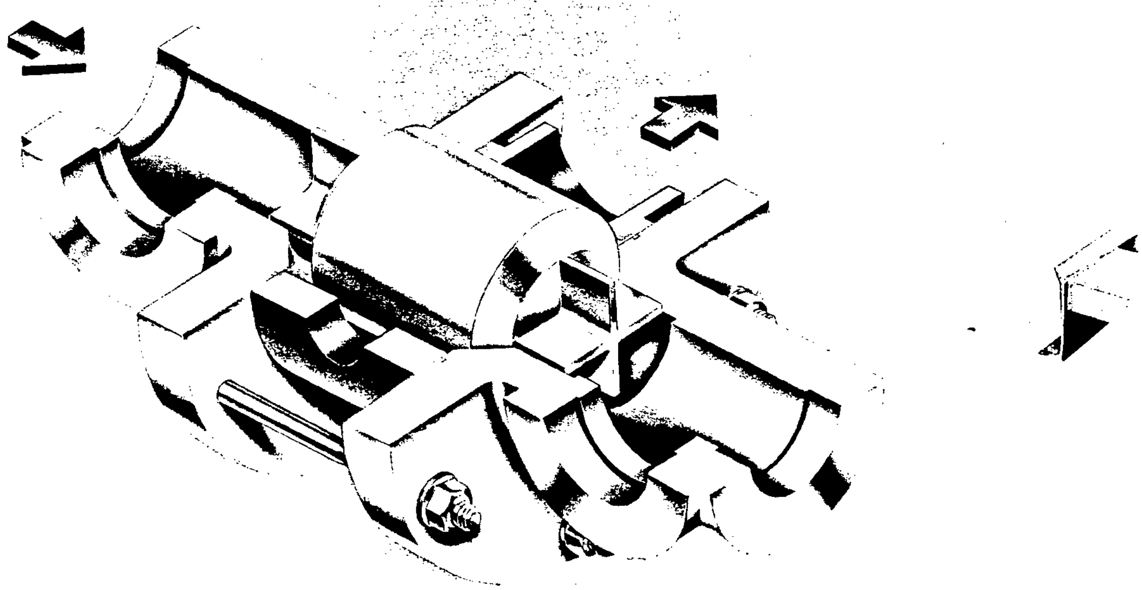
for superior performance and long operating life. Since the switching valves of a Desiccant Dryer are really the heart of any Desiccant Dryer, we have developed an exclusive valve design, offering the following advantages

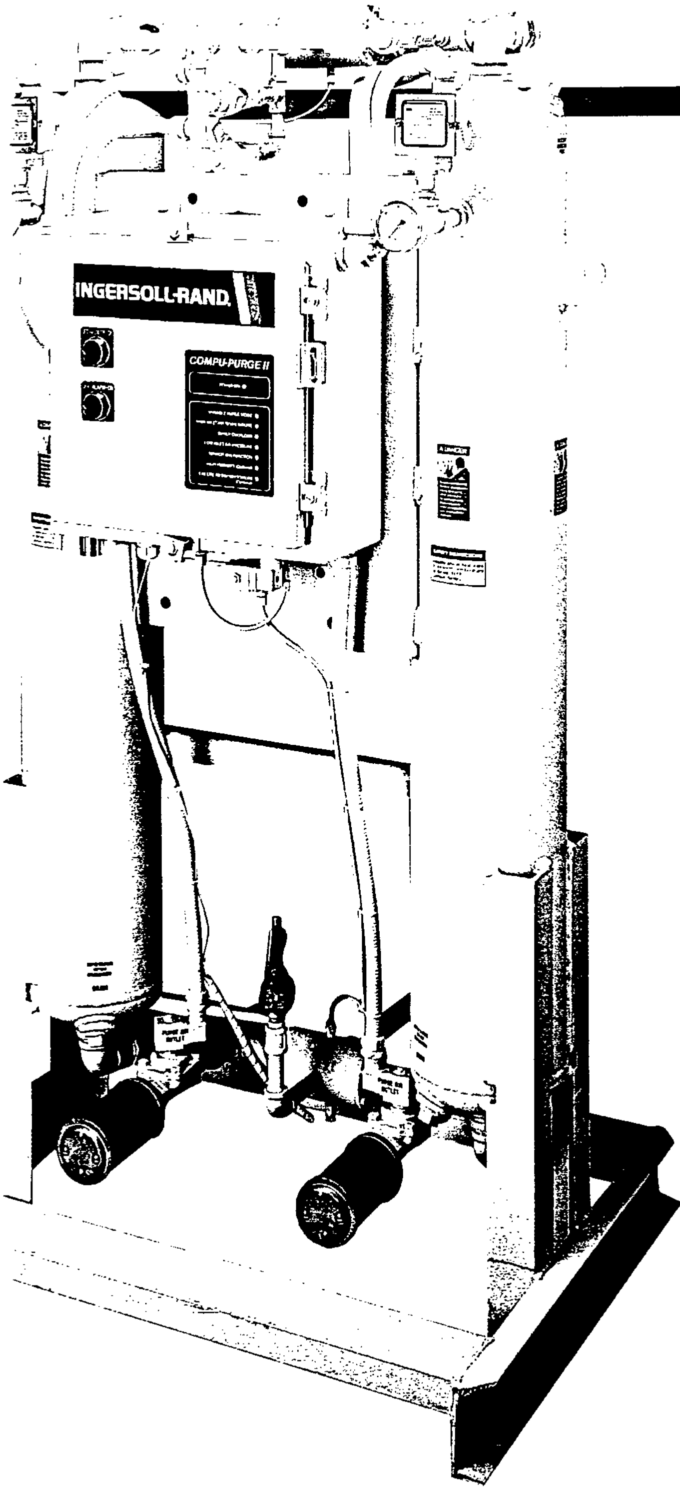
- Only one moving part in our Shuttle valves, eliminating the maintenance on actuators, control air regulators, filters and solenoids frequently seen on competitive designs.

- Extremely long and trouble-free service life. Our shuttle valves have been tested for more than 500,000 cycles without a problem, the equivalent of 10 years continuous operation. We are so confident of this design, we offer a **Lifetime Warranty On Valve Components.**

- Corrosion-resistant materials are used on all valve components, both internal and external.

- Continued compressed air flow, even with loss of electrical power to the dryer.





Reduced maintenance costs resulting from our use of only three (3) valves to control air flow switching, compared to as many as thirteen (13) separate valves used on some competitive designs.

Upflow drying, which protects the desiccant bed by minimizing the effects of water accidentally hitting the desiccant beads.

ASME designed and constructed pressure vessels to assure safety and high quality construction.

Pressure relief valve to comply with local codes.

Desiccant fill and drain ports eliminate the need to dismantle dryer piping, reducing maintenance time and cost.

Vessel pressure gauges identify drying and regeneration vessels at a glance.

Adjustable air purge control permits a purge rate of 13% to 17% (at 100 psig) to be selected for varying seasonal and process requirements.

Purge air flow indicator allows easy adjustment of purge flow rate.

Purge Air mufflers designed to meet OSHA standards for noise.

Fully automatic control system utilizes a time proven electric cam timer to control dryer functions reliably.

The Ingersoll-Rand HRD series offers an outstanding range of factory installed options to customize the dryer to your needs and desires.

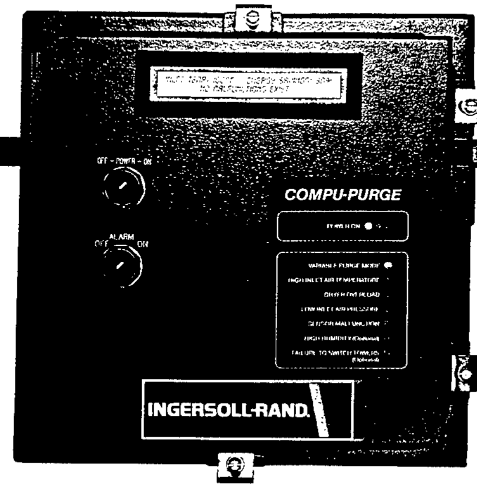
COMPU-PURGE® Control is our state of-the-art microprocessor based purge air control system, specifically designed to maximize energy savings by matching purge air usage to actual moisture loads on the dessicant bed.

COMPU-PURGE features:

- Active moisture load calculation
- Automatic programming of purge flow and purge time to match actual moisture load
- Self adjusting - no operator maintenance
- Simple - no wearing parts
- Constant dewpoint @ -40°F (-100°F optional)
- **Substantial** energy savings over constant purge cycle control

All Desiccant Dryers are specified and sized basis an assumed set of conditions including air flow, inlet temperature, inlet pressure and expected dewpoint, which then allows calculation of the total moisture load to be removed. Since most dryers are not constantly run at these conditions, most of the time fixed cycle controls tend to over-dry the desiccant, wasting energy. **COMPU-PURGE** is Ingersoll-Rand's answer to this situation, allowing the purge rate, and hence the energy consumption, to be minimized, matching the actual conditions being experienced and the actual moisture load to be removed.

COMPU-PURGE should be specified whenever the dryer is anticipated to operate less than 24 hours per day or when it is intended



to operate at reduced or fluctuating loads throughout the day. Energy savings will quickly recover the incremental price adder for **COMPU-PURGE**. The **COMPU-PURGE Savings Chart** effectively illustrates these savings.

Compu-Purge Savings

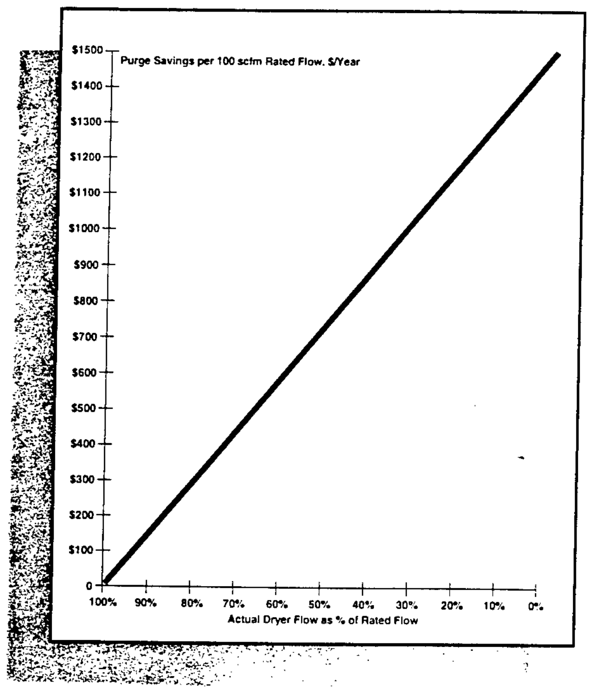
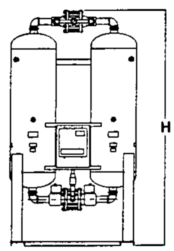
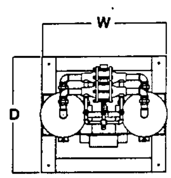


Chart assumes dryer operation at standard rating conditions of 100°F, 100 psig, 100% R.H. inlet air and -40°F pdp at 15% purge. Assume dryer usage at 365 days/year and air cost at $0.18/1000 scf.

Additional HRD series dryer options include:
- Switching Failure Light with alarm contact
- High Humidity Light with alarm contact
- Moisture Indicator
- -100°F Pressure Dewpoint
- NEMA 4, 12 Electrical Enclosure
- NEMA 7 (Class 1, Division II, Group D)
- Special Corrosion Resistant Paint
- 250 Psig Operating Pressure
- Pneumatic Controls
- Dewpoint Monitor
- 50 Cycle Operation
- Special Packaging of Filter and Dryer
- Other specially engineered options





Model	Capacity (1) (scfm)	Dimensions (inches) H	D	W	Inlet/Outlet (inches NPT)	Approx. Shipping Weight (lbs.)(2)
HRD5	100	67	28	36	1	800
HRD10	160	69	28	38	1	850
HRD15	200	85	40	38	1½	870
HRD20	275	85	40	39	1½	1020
HRD25	350	83	40	44	2	1140
HRD30	475	84	40	46	2	1680
HRD35	600	85	40	47	2	2000
HRD40	800	114	50	67	3	2620
HRD45	1000	115	50	68	3	3000
HRD50	1200	116	50	70	3	3500
HRD55	1440	117	50	72	3	4320
HRD60	1700	118	50	73	3	4950
HRD65	2000			**Consult Factory**		
HRD70	2265					
HRD75	2575					
HRD80	3240					
Larger models are available. Contact Factory for ratings and specifications.						

(1) Capacity is at standard rating conditions per NFPA/T3.27.3M R1-1981 (ANSI B93.45)-i.e., 100°F inlet air temperature, 100 psig inlet air pressure, 100°F inlet pressure dew point, and 100°F ambient temperature. Maximum pressure drop across dryer is 5 psi. Pressure dew point at standard rating conditions is -40°F.
(2) Desiccant shipped loose on Models HRD 40 and larger. Shipping weight for these models is less desiccant.

APPENDIX J

High Pressure Water Pump System Retrofit Calculations

APPENDIX J
Table of Contents

High Pressure Water Pump System Retrofit Calculations

The high pressure water pump system is housed in Building 117-6A, next to the steamout building. Five (5) high pressure water pumps serve operations in the steamout building. The pumps provide about 13,000 psig water to hydraulic cleaning equipment in building 117-6. Four of the five pumps are normally operated, with one as a spare.

The pumps are positive displacement pumps and are energized whenever the shakeout tables in building 117-6 are operated, about 10 hours per day, 6 days per week.

In order to maintain continuous high pressure water service to the washout lances, the pump discharges are recirculated to pump suctions. This requires all energized pumps to operate at peak load continuously.

Install Variable Frequency Drives to Control High Pressure Water Pump Speeds

A modification to high pressure water pump operation is proposed. Provide variable speed pump control, responding to demand at the washout lances. Variable speed control of the high pressure water pumps will reduce energy consumption, causing the pumps to operate at full load only when required, and will modulate pump speed under lower loads to only that speed needed to maintain water pressure.

High pressure water pump and pump motor nameplate data is as follows:

Pumps, 4 Each: Partec Equipment No. HC17F High Pressure Water Pump
Motor: 150 HP, 20 gpm, DO Pressure: 10,000 psig
Lube Type: O/M
Note: pump heads have been modified to provide 13,000 psig.

Pump Motors, 1 Each Pump: Toshiba, Model No.: B1504FL F4U3
Frame: 445T, Code 3, NEMA Class F, Design B
150 HP, Class F, Service Factor 1.15
460 VAC, 60 Hz, 1770 RPM, 178 FLA

Pumps heads have been modified from the original design pressure of 10,000 psig to operate at 13,000 psig. Operating load and power consumption measurements made during September 1994 are as follows:

		Amperage			Voltage	Power Factor			Calculated	% Full
Pump No.	Shaft RPM	A	B	C	Measured	A	B	C	kW	Load
1	1,777.6	156	162	164	464	0.83	0.83	0.82	106.7	74.7%
2	1,777.6	154	158	160	464	0.80	0.82	0.85	104.1	74.7%
3	Pump Off	NA	NA	NA	NA	NA	NA	NA	0	NA
4	1,775.8	166	163	169	464	0.82	0.82	0.82	109.4	80.7%
5	1,774.6	170	168	176	464	0.81	0.84	0.82	113.4	84.7%
Total for Operating Pumps (% Full Load is a kW-weighted average)									433.6	78.8%

No washout lances were operating at the time of these measurements, however, it is assumed that the load will remain the same because water is presently recirculated when no lances are operated and is not recirculated when the lances are in use.

Pump kW = Average Amps x Volts x $\sqrt{3}$ x Average Power Factor ÷ 1,000

Percent Full Load = (Synchronous RPM - Measured RPM) ÷ (Synchronous RPM - Full Load RPM)

Annual power consumption, based on operation 10 hours per day, 6 days per week is, thus: 1,352,872 kWH per year, or a cost of $59,193 per year not including electrical demand charges. Note that the operating schedule used for this calculation assumes WADF is operated at its design capacity, present operations require fewer operating hours per year and fluctuate.

The following load profile is assumed based on observations of steamout building operations and on discussions with shift workers at building 117-6.

% Load	Hr / Day	Pump kW[1]	kWH per Year	
0%	14	Off	0	
10%	3	13.8	12,914	
25%	2	34.5	21,524	
50%	2	69.0	43,048	
75%	2	103.5	64,572	
100%	1	138.0	43,048	
Subtotal	24	-	185,108	per pump (4 each are always operating)
Total, 4 Pumps On			740,430	Total Annual Power Consumption

Note 1:
The efficiency of the Butterworth positive displacement pumps installed in this facility is constant. Load is proportional to flow.

Annual power savings are estimated at: 612,442 kWH / year, 45% of present power usage by the high pressure pumps.

Annual operation and maintenance costs for the high pressure water pumps should be reduced because they are not operated at full capacity for extended periods. No cost benefit is taken for this assumption in order to provide a conservative analysis.

The concept has marginal economic analysis results and is, thus, recommended for implementation. Economic analysis results are summarized below on Table J-1.

The above retrofit assumes four pumps are operated during scheduled pump usage. Staged pump control is feasible and could save more energy. However, staged pump control would require cycling the high pressure pumps to follow the load. Motors of the size involved here cannot be cycled at the frequency required without being damaged, thus, pump cycling controls are not considered for this electric motor driven pump installation.

Replace Electric Motors on High Pressure Water Pumps with Internal Combustion Engines

High pressure pump drives could be replaced with internal combustion engines (ICE) to save energy costs. Use of ICEs would reduce electrical demand costs as well as usage costs as follows:

Present Power Consumption (before variable speed controls):	1,352,872 kWH/Yr
Present Electrical Demand of Electric Motor Drives (from measurements):	433.6 kW

ICEs that use No. 2 fuel oil are selected because natural gas is not available at WADF and propane tankage required would be prohibitively expensive.

Caterpillar Model 3306 Diesel Engine with Heavy Duty Clutch, Skid-Mounted with Day Tank

Full Load Fuel Consumption:	8.0 gph No. 2 Fuel Oil (138,700 BTU/gal)	1,109,600 BTUH
75% Load Fuel Consumption	6.0 gph No. 2 Fuel Oil (138,700 BTU/gal)	832,200 BTUH

The load and energy use profile shown below assumes pumps are brought on line as the load increases. Assumptions are generous, allowing greater energy savings for this screening analysis than would likely be available in an actual installation.

% Load	Hr / Day	ICE gph[2]	No ON	Million BTU/Yr	
0%	14	Off	0	0	
10%	3	6.0	1	778.9	
25%	2	8.0	1	692.4	
50%	2	8.0	2	1,384.8	
75%	2	8.0	3	2,077.2	
100%	1	8.0	4	1,384.8	
Total	24	-		6,318	Total Annual No. 2 Fuel Oil Consumption

Note 2:
The above fuel oil consumption calculation is based on manufacturer's peak and part load performance data and assumes pumps are brought on line as the load increases.

Unlike the VFD retrofit addressed above, replacing the existing motor drives on the high pressure water pumps with internal combustion engines is a major modification, requiring construction of a new pump building or an extension to the existing building. In order to provide a plan with the least potential disruption to existing WADF operations, it is assumed that a new pump building is constructed next to the existing pump building (Building No. 117-6A). High pressure water pumps could be moved and then brought on line one-at-a-time to allow for uninterrupted operations.

Underground No. 2 fuel oil storage is also required for this retrofit. Assume that tankage for a 30-day supply is required: 146 gpd x 30 days supply x 4 = 17,520 gallons.

Diesel engines require considerably more maintenance than do the existing electric motors. Assume O&M costs are only $0.01 per HP-Hour of operation, or about: $8,237 per year.

Table J-1. Summary of High Pressure Water Pump Drive Retrofit Evaluations

Economic Analysis Parameter	Install VFDs on Existing Motors	Replace Electric Motors with ICEs
Economic Life (per ECIP guidance):	20 Years	20 Years
Investment:	$168,767	$513,722
Annual Energy Cost Saved:	$26,796	$64,791
Annual O&M Cost Saved:	$0	($8,237)
Annual Non-Recurring Costs Saved:	$0	($6,479)
Total Annual (First Year) Cost Saved:	$26,796	$50,075
Life Cycle Energy Cost Saved:	$404,089	$841,919
Life Cycle O&M Cost Saved:	$0	($122,564)
Life Cycle, Non-Recurring Cost Saved:	$0	($96,408)
Total Life Cycle Cost Saved:	$404,089	$622,947
Savings to Investment Ratio:	2.39	1.21
Payback Period:	6.30 Years	10.26 Years
	Recommended for Implementation	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location: Hawthorne Army Ammunition Plant Region No. 4 Project No.
Western Area Demilitarization Facility (WADF), Nevada

Project Title: ECIP Facility Energy Improvements Fiscal Year FY97

Install Variable Speed Drives on High Pressure Water Pumps in Building 117-6A

Analysis Date: November 1994 Economic Life: 20 Years Preparer: KELLER & GANNON

1. Investment Costs

A. Construction Costs	$150,684		
B. SIOH	$ 9,041		
C. Design Cost	$ 9,041		
D. Total Cost (1A+1B+1C)	$ 168,767		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$168,767

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)	Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	2,090	$26,796	15.08	$404,089
B. Dist	$6.13		$0	18.57	$0
C. LPG	-	-			
D. Other	-	-			
E. Elec Demand	$102.21	0.0 kW	$0	15.08	$0
F. Total		2,090.3	$26,796		$404,089

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	$0		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			$0

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.				$0
b.				$0
c.				$0
d. Total	$0			$0

C Total Non Energy Discounted Savings (3A2+3Bd4) $0

4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$26,796	
5. Simple Payback (1G/4):	6.30	Years
6. Total Net Discounted Savings (2F5+3C):	$404,089	
7. Savings to Investment Ratio (SIR) 6/1G:	2.39	

Life Cycle Cost Analysis Summary
Energy Conservation Investment Program (ECIP)

Location:	Hawthorne Army Ammunition Plant Region No. 4 Western Area Demilitarization Facility (WADF), Nevada	Project No.	
Project Title:	ECIP Facility Energy Improvements **Install Internal Combustion Engine to Replace Electric Motors on on High Pressure Water Pumps in Building 117-6A**	Fiscal Year	FY97
Analysis Date:	November 1994 Economic Life: 20 Years	Preparer:	KELLER & GANNON

1. Investment Costs

A. Construction Costs	$458,680		
B. SIOH	$ 27,521		
C. Design Cost	$ 27,521		
D. Total Cost (1A+1B+1C)	$ 513,722		
E. Salvage Value of Existing Equipment		$0	
F. Public Utility Company Rebate		$0	
G. Total Investment (1D-1E-1F)			$513,722

2. Energy Savings (+)/Cost(-):

Date of NISTIR 85-3273 Used for Discount Factors: October 1994

Energy Source	Cost $/MBTU(1)	Saving MBTU/Yr(2)		Annual $ Savings(3)	Discount Factor(4)	Discounted Savings(5)
A. Elec.	$12.82	4,617		$59,193	15.08	$892,624
B. Dist	$6.13	(6,318)		($38,719)	18.57	($719,016)
C. LPG	-	-				
D. Other	-	-				
E. Elec Demand	$102.21	433.6	kW	$44,318	15.08	$668,310
F. Total		(1,701)		$64,791		$841,919

3. Non Energy Savings (+) or Cost (-):

A. Annual Recurring (+/-)	($8,237)		
(1) Discount Factor (Table A)		14.88	
(2) Discounted Savings/Cost (3A x 3A1)			($122,564)

B. Non Recurring Savings (+) or Cost (-)

Item	Savings(+) Cost(-)(1)	Year of Occur. (2)	Discount Factor(3)	Discounted Savings(+) Cost(-) (4)
a.	($129,581)	10	0.744	($96,408)
b.				
c.				
d. Total	($129,581)			($96,408)

C Total Non Energy Discounted Savings (3A2+3Bd4)	($218,972)	
4. First Year Dollar Savings (2F3+3A+(3Bd1/Years Economic Life)):	$50,075	
5. Simple Payback (1G/4):	10.26	Years
6. Total Net Discounted Savings (2F5+3C):	$622,947	
7. Savings to Investment Ratio (SIR) 6/1G:	1.21	

CONSTRUCTION COST ESTIMATE				Date Prepared November-94		Sheet 1	of 1
Project: ECIP Facility Energy Improvements				Project No.	Basis for Estimate: Code A (no design competed)		
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada							
Engineer-Architect: Keller & Gannon							
Drawing No.		Estimator: BIH			Checked By: RCL		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-6A: Install Variable Speed Drives to Control High Pressure Water Pumps							
Install ABB Model ACH-500 Variable Frequency Drives on 150HP Motors	5	EA	$1,500	$7,500	$18,700	$93,500	$101,000
Differential Pressure Controller to Modulate Pump Speed	1	EA	$165	$165	$350	$350	$515
Pressure Sensor, Electric Operated	1	EA	$60.85	$61	$518.56	$519	$579
Conduit and Wiring Allowance	1	Job	$1,298	$1,298	$1,000	$1,000	$2,298
Subtotal				$9,024		$95,369	$104,393
Nevada Sales Tax	3.75%	%		-		$3,576	$3,576
Subtotal							$107,969
Contractor OH & Profit	25.0%	%					$26,992
Subtotal							$134,961
Bond	1.5%	%					$2,024
Subtotal							$136,986
Estimating Contingency	10.0%	%					$13,699
Total Probable Construction Cost							**$150,684**

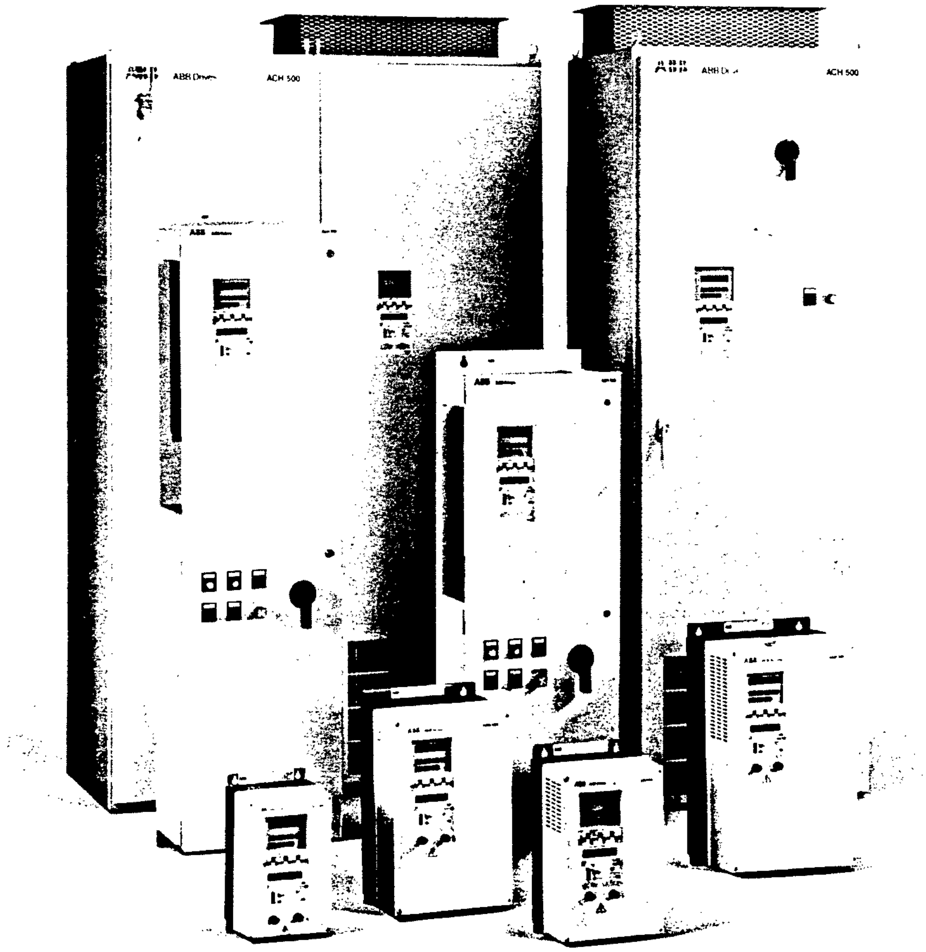
CONSTRUCTION COST ESTIMATE				Date Prepared: November-94		Sheet 1	of 1
Project: ECIP Facility Energy Improvements				Project No.	Basis for Estimate		
Location: Western Area Demilitarization Facility (WADF) Hawthorne Army Ammunition Plant, Nevada					Code A (no design competed)		
Engineer-Architect: Keller & Gannon							
Drawing No.		Estimator: BIH			Checked By: RCL		

Line Item	Quantity No. Units	Quantity Unit Meas.	Labor Per Unit	Labor Total	Material Per Unit	Material Total	Total Cost
Building 117-6A: Retrofit Internal Combustion Engines on High Pressure Water Pumps							
15,000 Gal Fiberglass Underground Double-Wall Tank, incl. manways	1	EA	$3,555	$3,555	$14,287	$14,287	$17,842
Tank Excavation and Backfill	1	Job	$3,057	$3,057	$0.00	$0	$3,057
Fuel Oil Circulation Pump 36 gph	1	EA	$101.59	$102	$529.25	$529	$631
Tank/Piping Leak Detection Controller, 8 Channel, monitoring	1	EA	$162	$162	$1,737	$1,737	$1,900
Secondary Containment Hydrocarbon Liquid & Vapor Probe	1	EA	$85	$85	$920	$920	$1,004
Tank Annular Space Monitoring Well, Chemical Monitoring	1	EA	$85	$85	$684	$684	$769
Tank Internals, allowance	1	Job	$169	$169	$1,500	$1,500	$1,669
Fuel Piping, 2-inch Service & 3-inch Containment, FRP Pipe & Fittings	200	LF	$8.71	$1,742	$29.81	$5,963	$7,704
Caterpillar Diesel Engine Drive & Heavy Duty Clutch: MN 3306	5	EA	$1,016	$5,080	$24,000	$120,000	$125,080
Differential Pressure Controller to Modulate Pump Speed	1	EA	$165	$165	$350	$350	$515
Pressure Sensor, Electric Operated	1	EA	$60.85	$61	$518.56	$519	$579
Conduit and Wiring Allowance	1	Job	$1,298	$1,298	$1,000	$1,000	$2,298
High Pressure Piping Modifications	370	LF	$33.22	$12,290	$87.67	$32,440	$44,729
Reset Pumps from Building 117-6A to New Pump Building	5	EA	$1,298	$6,490	$750	$3,750	$10,240
New Building, complete	2,000	SF	Included		$50	$100,000	$100,000
Subtotal				$34,340		$283,678	$318,018
Nevada Sales Tax	3.75%	%		-		$10,638	$10,638
Subtotal							$328,656
Contractor OH & Profit	25.0%	%					$82,164
Subtotal							$410,820
Bond	1.5%	%					$6,162
Subtotal							$416,982
Estimating Contingency	10.0%	%					$41,698
Total Probable Construction Cost							**$458,680**

Internal combustion engines in the type of service anticipated are assumed to require replacement about every 10 years. Costs for engine replacements only per above **$129,581** each 10 years.

ACH 500 Series
Adjustable Frequency AC Drives

Product Bulletin
ACH500-02A



The ACH 500 series is a microprocessor based Pulse Width Modulated (PWM) adjustable frequency AC drive. The ACH 500 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for varied HVAC applications.

With drives ranging from 2 to 400 HP, the ACH 500 series features a universal alphanumeric interface that "speaks" to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis.

Each ACH 500 drive comes equipped with a library of pre-programmed application macros, which at a touch of a button, allow rapid configuration of inputs, outputs, and performance parameters for your HVAC applications to maximize convenience and minimize start-up time.

The ACH 500 series can handle the most demanding HVAC applications in an efficient, dependable, and economic manner.

ABB
ASEA BROWN BOVERI

Effective 4/1/93
Supersedes 6/15/92

FEATURES

STANDARD FEATURES

- UL Listed
- CSA (Applied For)
- 40 Character Multi-lingual Alphanumeric Display For:
  - Output Frequency
  - Speed (RPM, %, or user programmable)
  - Motor Current
  - Calculated Motor Torque
  - Calculated Motor Power
  - DC Bus Voltage
  - Output Voltage
  - Heatsink Temperature (°F & °C)
  - Elapsed Time Meter
  - kWh Meter
  - Parameter Data
  - Fault Text
  - Warning Text
  - Supervision Text
- RS-485 Communications
- Two (2) Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Three (3) Programmable Form C Relay Outputs
- Adjustable Filters On Analog Inputs and Outputs
- Input Speed Signals
  - Current 0(4)-20 mA
  - Voltage 0(2)-10 VDC
  - Increase/Decrease Speed Contacts
  - RS-485 Communications
- Start/Stop
  - 2 Wire (Dry Contact Closure)
  - 3 Wire (Momentary Dry Contacts)
  - Application Of Input Power
- All Control Inputs Isolated From Ground and Power
- Protection Circuits
  - Over Current
  - Ground Fault
  - Over Voltage
  - Under Voltage
  - Over Temperature
  - Adaptable Electronic Motor Overload (I^2t)
- Input Line Fuses
- Stall Protection
- Underload Function
- Three (3) Current Limit Circuits
- Electronic Reverse
- Rapid Reverse
- DC Injection Braking
- DC Hold
- Auto Restart-Customer Selectable and Adjustable
- Two (2) Independently Adjustable Accel and Decel Ramps
- Linear Or three (3) "S" Curve Accel/Decel Ramps
- Ramp Or Coast To A Stop
- Programmable Maximum Frequency To 500 Hz (ACH 501)
- Integral Programmable PI Setpoint Controller
- Mathematical Functions on Analog Signals
- Seven (7) Preset Speeds
- Five (5) Critical Frequency Lockout Bands
- V/Hz Shape
  - Linear
  - Squared
  - Automatic
- Start Functions
  - Ramp
  - Flying Start
  - Automatic Torque Boost
- Automatic Slip Compensation (selectable)
- IR Compensation - Manual or Automatic
- Automatic Extended Power Loss Ride Through (selectable)
- DC Line Reactor

OPTIONAL FEATURES

- Disconnect Switch
- Circuit Breaker
- Manual Bypass
- Automatic Bypass
- Service Switch
- Motor Overload Relay(s)
- Analog Meters
- 115 VAC Control Interface
- AC Line Reactors
- Intelligent Remote Keypad/Display Panel
- Pressure (3-15 psi) to Electric Transducer
- Digital Input Isolators

SPECIFICATIONS

Input Connection

- Voltage (V_{IN}) .... **480 volt units** - 3 phase, 440/460/480/500 +/-10% permitted tolerance
  .... **230 volt units** - 3 phase, 208/220/230/240 +/-10% permitted tolerance
- Frequency .... 48... 63 Hz
- Power factor: For fundamental .... ~ 0.98

Motor Connection

- Output voltage: .... 3ϕ 0 to V_{IN} (V_{max} at field weakening point)
- Output frequency: .... 0 to 500 Hz (ACH 501), 0 to 120 Hz (ACH 502)
- Frequency resolution: .... 0.01 Hz Digital, 0 to 120 Hz; 0.1 Hz >120 Hz
  .... 12 BIT - analog input 2
  .... 10 BIT - analog input 1
- Switching frequency f_s .... 1.0 to 12.0 kHz (ACH 501) factory set at 3kHz
  .... 3.0 kHz (ACH 502)
- Continuous output current:
  Variable torque: .... Rated I_{RSQ} (Rated current, Variable Torque)
- Overload Capacity:
  Variable torque: .... 1.1 x I_{RSQ}, for 1 min every 10 min
- Starting duty: .... Approx. 1.4 x I_{RSQ} for 2 sec every 15 sec
- Field weakening point: .... 30 to 500 Hz (ACH 501), 30 to 180 Hz (ACH 502)
- Acceleration time: .... 0.1 to 1800 sec.
- Deceleration time: .... 0.1 to 1800 sec.
- Enclosure: .... NEMA 12, NEMA 1, chassis
- Environmental limits:
  Ambient operating temperature (f_s=3 kHz):
  Variable torque: .... 32 to 104°F (0 to 40° C) NEMA 1
  Variable torque: .... 32 to 95°F (0 to 35°C) NEMA 12
  Storage temperature: .... -40 to +158°F (-40 to +70°C)
  Cooling method: .... Integral fan(s)
  Relative humidity: .... max 95%, no condensation allowed
  Altitude: max .... 3300 ft. (1000 m) above sea level (100% load)
  .... 1% derating every 330 ft. above 3300 ft.
- Agency Approval .... UL, CSA Applied For

External Control Connections

- Two programmable Analog Inputs:
  Voltage reference: .... 0 to 10 V, 200k ohm single ended
  Current reference: .... 0 to 20 mA, 250 ohms single ended
  Potentiometer .... 10 VDC, 10 mA (1K to 10K ohms)
- Auxiliary voltage: .... +24 VDC, max 200 mA
- Six Programmable Digital Inputs .... 24 VDC
- Two Programmable Analog Outputs: .... 0 (4) to 20 mA, 500 ohm maximum load
- Three Programmable Relay (Form C) Outputs:
  Max switching voltage .... 300 VDC/250 VAC
  Max switching current .... 8 A/24 VDC, 0.4 A/250 VDC
  Max switching power .... 2000 VA/250 VAC
  Max continuous current 2A

Protections:
  Overcurrent trip limit: .... 315% instantaneous, 225% (RMS)
  Slow current regulation limit: .... 125% (RMS) max.
  Rapid current regulation limit: .... 170% (RMS) max.
  Current switch-off limit: .... 255% instantaneous, 175% (RMS) ACH 501
  .... 315% instantaneous, 225% (RMS) ACH 502
  Overvoltage trip limit: 130%
  Undervoltage trip limit: 65%
  Overtemperature (heatsink): .... +158°F (+70°C) ACH 501, +185°F (+85°C) ACH 502
  Auxiliary voltage: .... Short Circuit Protected
  Ground fault: .... Running (ACH 501); At Start (ACH 502)
  Microprocessor fault: .... Protected
  Motor stall protection .... Protected
  Motor overtemperature protection (I^2t) .... Protected
  AC Line Fuses .... Standard

Specifications are subject to change without notice. Consult factory when specifications are critical.

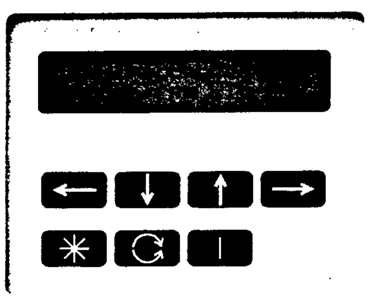
DRIVE FEATURES - OPERATOR INTERFACE

■ 2-Line, 40-Character, Multilingual Alphanumeric Display

Highly legible liquid crystal display (LCD) can access more than 120 parameter names, 330 values (including energy consumption and elapsed time), plus an array of fault and warning messages. The ACH 500 presents this information in "plain" English (no codes) (or 8 other user-selected languages, including: French, Spanish, German, Italian, Swedish, Finnish, Danish and Dutch).

■ Keypad Control Panel

ACH 500 drives are equipped with an easily recognizable seven (7) button digital keypad, which allows error-free programming, data input, and operator interface via the front face of the drive.



■ Parameters Organized into Groups

The parameters in the ACH 500 are organized into functional groups and are accessed via a system of menus, rather than having to step through hundreds of parameters sequentially. This makes finding the right parameter much easier and quicker.

■ Application Macros

The ACH 500 offers a choice of four (4) HVAC application macros and has been designed to offer users the ability to program common applications in a simple and flexible manner. By using the application macros supplied as standard with all ACH 500's, building-wide standardization will be greatly simplified.

These macros allow for complete configuring of the analog and digital I/O's, and certain drive parameters for specific applications. In addition, the function of each of the analog or digital I/O's or drive parameters may be customized, providing added flexibility.

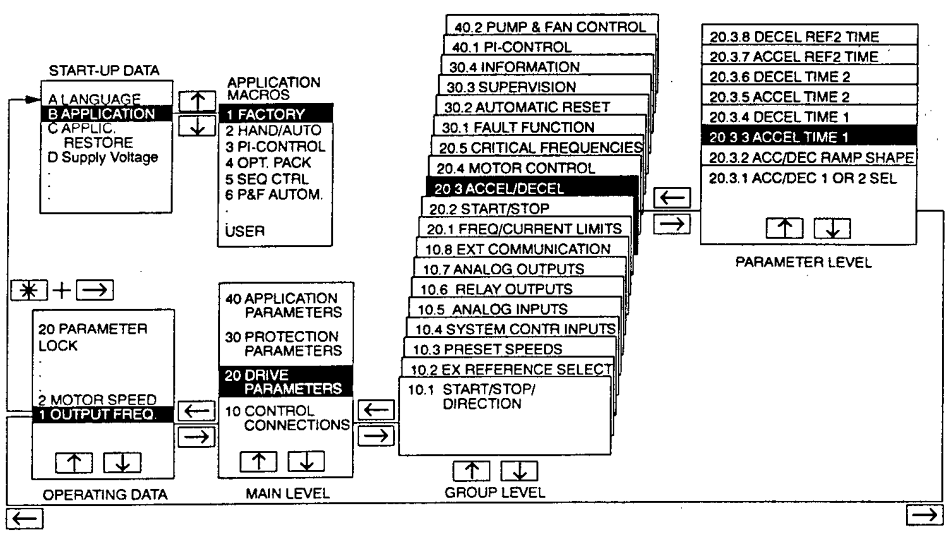
■ Programmable Analog and Digital Inputs and Outputs

Two analog and six digital inputs along with two analog and three relay (Form C) outputs, all programmable, are standard on the ACH 500.

Interfacing with direct digital controllers (DDC), programmable logic controllers (PLC's) or other high level automation systems is accomplished by means of the ACH 500's standard control interface card. This card provides for two analog and six digital inputs, along with two analog and three relay (Form C) outputs, all programmable.

■ Customer Terminal Strip

The common circuit potential of the customer terminal strip is optically isolated from power circuits, and resistively isolated from the chassis by a 10 Megohm resistor.



DRIVE FEATURES - OPERATOR INTERFACE (cont'd)

■ Serial Communication

RS-485 serial communications port to support a Remote Panel, as well as PC and PLC for monitoring and control is standard on the ACH 500.

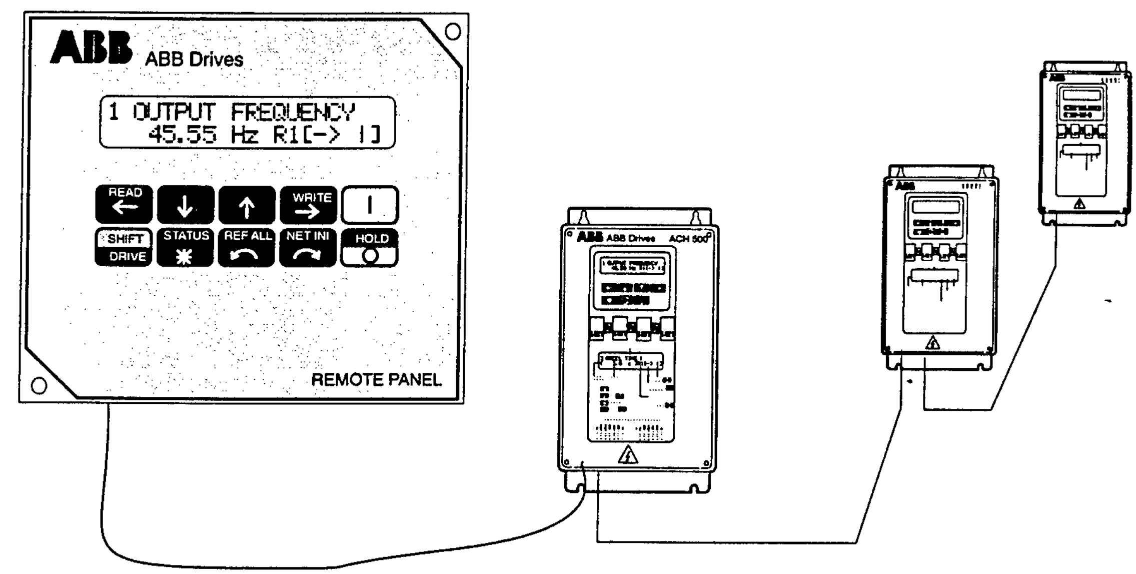
■ Remote Panel (Optional)

The Remote Panel is a Keypad/Display that provides the the same alpha-numeric display and functionality as the standard local panel mounted on the ACS 500. This panel can be mounted at a remote location.

The Remote Panel can be used with any ACH 500 drive manufactured after January 1993. One panel can control up to 31 ACH 500's. All drive functions that can be performed at the drive keypad can also be performed with the Remote Panel. Speed, Start/Stop, and Direction commands can be broadcast simultaneously to all drives connected. Network initialization (configuration) is also performed by the Remote Panel. Additionally, the Remote Panel can be used to upload all drive parameters and store them in memory. They can then be downloaded to another drive. The remote panel controls the ACH 500 via the RS-485 Serial Communication Link. A 9.8 ft. (3 m) cable is included to connect to the first drive (maximum distance allowable with drive supplied power). Maximum length of the RS-485 cable is 3,937 feet (1200 m) if a separate (9 v ±1 v, 200mA) power supply is provided for the panel.

■ Hand-Off-Auto Switch & Speed Pot

Cover-mounted switch is prewired at the factory to allow the user to select one of three modes. In HAND, the drive will be started, and the speed will be controlled by the cover-mounted speed potentiometer. In OFF, the drive will be stopped. In AUTO, the drive will be started by a remote contact closure provided by the customer, and the speed will be controlled by a remote signal (voltage, current or pneumatic).



DRIVE FEATURES - POWER

■ Three Current Limit Circuits and 225% O.C. Trip

The ACH 500's current limit circuitry and 225% (315% peak) overcurrent trip level, allows the ACH 500 to operate as a "tripless" drive. The three current limit circuits dynamically control motor current and prevent excessive motor current from unduly tripping the drive. The three current limit functions operate as follows:

1. Rapid Current Regulation.
   The Rapid Current Regulation is adjustable from 50% to 170%. If the motor current exceeds the Current Limit setting, the ACH 500 will stop, and decrease the output frequency until the motor current is reduced below the current limit level, at which time the output frequency will accelerate (at the rate set by the acceleration time) to the set frequency. The Rapid Current Regulation allows up to 200% current to be drawn for a short period of time before the current is reduced to the Slow Current Regulation Limit.
2. Slow Current Regulation.
   Adjustable from 50% to 125% of the ACH 500's rated current, this current regulation circuit operates similarly to the Rapid Current Regulation, except at a slower rate.
3. Current Switch-Off Limit.
   When the rapid current regulation limit is exceeded, and the Current Switch-Off Limit is reached (255% peak in ACH 501 and 315% peak in ACH 502) the output voltage to the motor is shut off momentarily. Every two to three milliseconds, the output voltage is switched back on to take control of the motor. If the current is not below the 150% level, voltage will again be switched off.

   This function will operate 10 times to control the motor current prior to it either controlling the motor, or shutting down the drive on an overcurrent trip.

■ DC Line Reactor

A DC Line Reactor is standard equipment on the ACH 500. This added impedance to the DC link results in several improvements over Pulse Width Modulated (PWM) drives not so equipped. Displacement power factor is thus improved, and lower harmonic distortion on the power line is achieved without additional line inductors or transformers. For harmonic distortion calculations, please contact the factory.

■ IGBT Power Electronics

The ACH 500 uses the latest IGBT (Insulated Gate Bi-Polar Transistor) power switching devices. These fast response IGBT's allow "tripless" operation enabling 100% motor load capability at a motor's rated load. This minimizes the derating requirements of the motor. In addition, audible motor noise is significantly reduced, which means the ACH 500 can be used in applications where low noise levels are essential. Other significant advantages of this technology are:

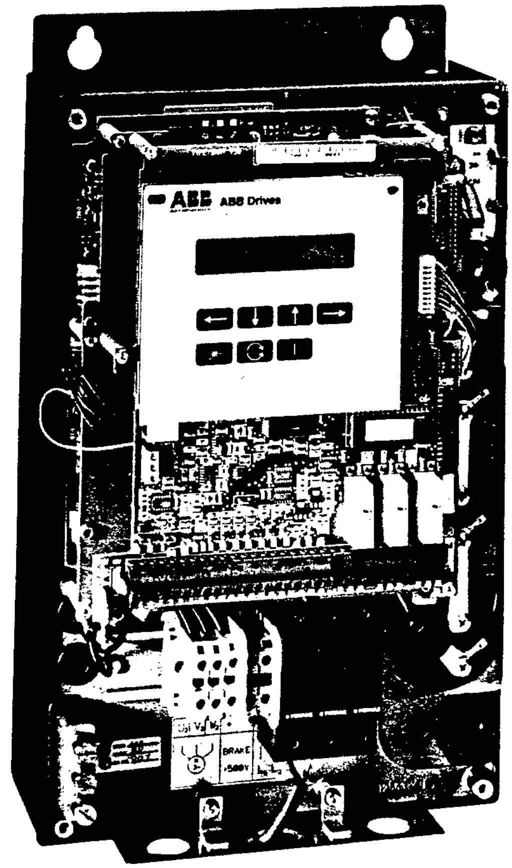
- Minimal gate currents are achieved for the control of large motor currents. This minimizes the power of the gate circuits and allows lower power supply requirements; resulting in greater commonality of spare parts.
- The inherently fast switching rates of the ACH 500 result in smoother motor control when compared to switching rates below 1 kHz. In addition, they minimize the derating requirements of the AC motor at nominal speed while assuring reliable and safe shut-downs during fault conditions.
- Minimal switching losses of IGBT's result in better efficiency and allows for smaller enclosures.

DRIVE FEATURES - PROTECTION

■ Power Line Protection

The ACH 500 has built-in fast acting semi-conductor input fuses as standard inside the standard.

Power line voltage surge protection is provided by means of a Metal Oxide Varistor (M.O.V.) across the DC bus or the AC line. This protects the diodes in the ACH 500's 3-phase full wave bridge.



■ Integral Protection Circuits

The ACH 500 was designed to protect the drive and motor from the hazards of continuous service in the most demanding of applications. Built-in protection circuits include the following:

- Overcurrent trip limit - 375% instantaneous
- Slow current regulation limit -150%
- Rapid current regulation limit-200% adjustable
- Current switch-off limit-300% instantaneous
- Overvoltage trip limit -130%
- Undervoltage trip limit -65%
- Over temperature protection - YES
- Ground fault protection - YES (see specifications)
- Microprocessor protection - YES
- Motor stall protection - YES
- Smart Motor overload protection (I^2t) - YES
- Single phasing on input in ACH 502 drives

■ NEMA 12, NEMA 1, Chassis Offerings

The ACH 500 is available in both NEMA 1 ventilated and NEMA 12 (dust tight) enclosures. These enclosures incorporate rugged die cast backs in wall-hung units (up to 75 HP variable torque). ACH 500 drives can also be chassis mounted for OEM applications, or for inclusion in site-specific enclosures.

DRIVE FEATURES - CONTROL

■ Acceleration/Deceleration Rates

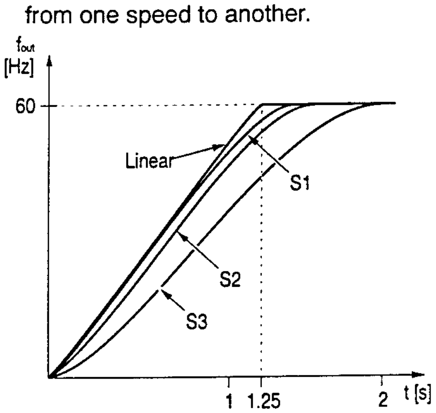
The ACH 500 provides two individually controlled, selectable sets of acceleration/deceleration rates from 0.1 to 1800 seconds.

Min. theoretical time -120 Hz/0.1 seconds

Max. theoretical time - 120 Hz/1800 seconds

Switching between the two accel/decel rates may be controlled via a program designated digital input (Parameter 20.3.1).

- **Linear or "S" Curve Ramping**
  The ACH 500 also offers selection of the shape of the acceleration/deceleration ramp curves; linear or 3 different S-curves. S-curve ramps are ideal for applications where a smooth transition is required when changing from one speed to another.



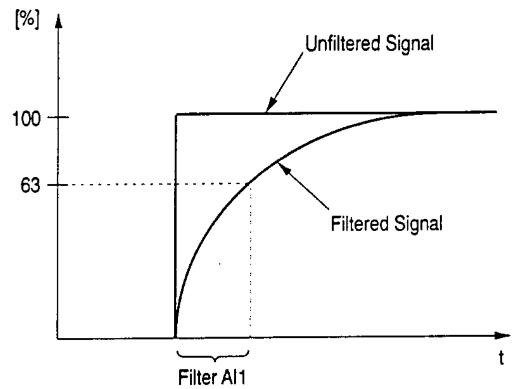
A Linear curve selection is suitable for drives requiring steady acceleration/deceleration and/ or slow ramps. Three "S" curves are also available:

- S1 Shape-Suitable for ramp times <1 second.
- S2 Shape-Suitable for ramp times <1.5 seconds.
- S3 Shape-Suitable for ramp times up to 15 seconds.

■ Analog Inputs

The ACH 500 has two analog inputs as standard which are both capable of operating from 0-10 VDC or 0-20 mA, or from a potentiometer. Each of these analog inputs can then be altered by activating the following parameters:

- **Analog Input Filters**
  With this parameter, a time of between 0.01 to 10 seconds can be specified which will RC Filter the analog input signal. 63% of the change of the analog input takes place within the time period given by this parameter. (If the minimum value of 0.01 seconds is selected, the signal is not filtered.)



- **Analog Input Min/Max Settings**
  The Analog Input Minimum setting operates as an input offset, allowing settings of 0V/0mA or 2V/4mA to be the input signal required to begin accelerating from minimum speed. An automatic offset adjustment allows the user to input the minimum analog input setting and scale the drive so it will not start to accelerate from zero speed until the offset input signal is exceeded.

  The Analog Input Max setting is the analog input signal corresponding to the maximum signal that will be applied. This may be set such that 10V/20MA is the full speed, or an automatic gain setting may be used, such that the user inputs the maximum speed signal and it scales the drive output so that full speed is achieved at this point.

- **Analog Input Inversion**
  The analog input signal can be inverted so that the minimum analog input signal can correspond to the maximum reference and the maximum analog input signal can correspond to the minimum reference.

DRIVE FEATURES - CONTROL (cont'd)

■ External References

The ACH 500 can be controlled from two external control locations, referred to as 'external references'. Each external reference can have a different Start/Stop and Speed Input, or they can be programmed to be the same signal. For example, you could have a start/stop push-button station as the start/stop for both references, and select between two different speed signals; or you could have one speed signal and select between a start/stop push-button station and the keypad start/stop.

The ACH 500 can accept a variety of speed references, such as:

- **Analog Reference**
  The ACH 500 speed reference can be supplied to one of the two analog inputs on the customer terminal strip.
- **Floating Point Control**
  The ACH 500 has a Floating Point input as a standard feature. By using two digital inputs for the speed reference, you can connect two dry-contacts, such as a Dwyer Photohelic® gage, to the ACH 500. One contact, when closed, will cause the ACH 500 to increase speed; the other contact will cause the ACH 500 to decrease speed.
- **Keypad**
  The ACH 500 keypad can also be used for the external reference.
- **Reference Scaling**
  The two external references can each be independently scaled, so that the minimum and maximum analog input can correspond to a frequency other than the minimum and maximum frequency. This is very useful, for example, if you want to apply the same 0 - 10 VDC reference to two or more drives, and want one drive to operate from 0 to 60 Hz and the other to operate from 0 to 53 Hz.
- **Mathematical Functions**
  The ACH 500 can perform mathematical functions on the signals connected to the analog inputs. These functions are: Addition, Subtraction, Multiplication, Square root, Sum of the square roots, Minimum, and Maximum.

  For example, if you select the multiplication function, the ACH 500 will multiply the signal on Analog Input 1 by the signal on Analog Input 2. That is, if Analog Input 1 was set to 50% speed, and Analog Input 2 was being used to ratio the speed, then when Analog Input 2 is at zero, the output frequency would be zero. When Analog Output 2 is at 50%, the output frequency would be 25%, and when Analog Output 2 is at 100%, the output frequency would be 50%.

■ Analog Outputs

Analog output signals are 0(4) to 20mA and can be proportional to output frequency, motor speed, output current, motor torque, motor power, DC Bus voltage, motor voltage, or the active reference. These signals can be scaled (10 to 1 Gain) so that small or large changes in the parameter can represent full scale.

■ Auto Restarts

The ACH 500 Drive can automatically restart after a fault by selecting the following parameters:

- Number of Trials - 0 to 5 restart attempts can be specified.
- Trial Time - 1 to 180 seconds can be specified. This defines the period of time that the ACH 500 may experience the programmed number of restarts and remain on line. If the application causes the ACH 500 to trip more than the number of trials set within the programmed trial time, the ACH 500 will stop operating and display the fault on its display screen.
- Time between reset attempts can be programmed from 0 to 120 seconds. The time until reset occurs counts down on the display.
- Overvoltage, Undervoltage, Overcurrent and Analog Input <2V/4mA can be selected. Normal operation is restored after the fault condition has been corrected. However, if the fault is not cleared, the drive stops.

DRIVE FEATURES - CONTROL (cont'd)

■ Carrier Frequency

By utilizing IGBT's, the ACH 500 drive employs high switching frequencies, so the motor current is practically sinusoidal. Audible motor noise can also be minimized by choosing a switching frequency up to 12kHz in the ACH 501. These frequencies can be adjusted or changed to best fit the application. When raising the switching frequency above 3 kHz, the switching losses in the drive will increase. Derating may be necessary, depending on the application.

■ Critical Frequency Lockouts

For applications where it may be necessary to avoid specific frequencies due to mechanical resonance problems in the driven equipment, the ACH 500, with its Critical Frequency Lockout Function, makes it possible to set-up five different frequency ranges which will be avoided during operation of the drive.

Each critical frequency setting allows the user to set low and high critical frequency limits. If the speed reference signal requires the ACH 500 to operate within this critical frequency range, the critical frequency lockout function will keep the ACH 500 operating at the low (or high) limit until the reference is out of the critical frequency range, at which time the output frequency will ramp through the critical frequency range at the set accel or decel ramp.

■ Extended Power Loss Ride-through

The ACH 500 is equipped with an automatic extended power loss ride-through circuit.

This circuit utilizes the inertia of the load to keep the drive powered. The minimum power loss ride-through is one-cycle (16.6 milliseconds), based on full load and no inertia. However, because inertia of the load generates power to the drive, the ACH 500's power loss ride-through capability can be extended well beyond one cycle, depending on the load inertia.

■ Input Power

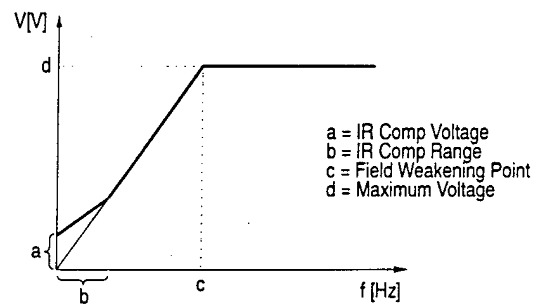
One of the more unique features of the ACH 500 is its ability to operate from wide range of input power potentials.

Most U.S. based power systems operate at 480 VAC +10% and many AC drives are rated for only 460 VAC + 10%. This results in a maximum operational voltage from 506 VAC to 528 VAC where the utility is within specifications, but above most drives' capabilities. The ACH 500's flexibility allows for operation at 500 VAC + 10% (i.e. 550 VAC maximum). Benefit - ability to operate on high lines without nuisance overvoltage trips.

■ IR Compensation

A complete set of parameters is included in the ACH 500 which allows for extra torque to be applied at speeds between 0.1 Hz and the set field weakening point (Programmable Range). The following settings are available:

- NO
- MANUAL
- AUTOMATIC



This provides for higher voltage at low speeds anytime during operation (not just at initial start-up; i.e. start function with torque boost). In Automatic, the IR Compensation voltage is set automatically as a function of effective motor current. In Manual, both the IR-Comp Voltage and IR-Comp Range are adjustable.

■ Overvoltage Limit

High DC Bus voltage (caused by overhauling loads) will cause frequency to increase instead of causing the drive to trip Overvoltage. The voltage limit circuits can be disabled for applications where a change in speed is not allowed.

■ Parameter Lock

Prevents unauthorized persons from altering the parameters of the ACH 500 by providing a programmable combination number. To open the Parameter Lock, the correct combination must be entered. The parameter lock can also be set to a digital input.

■ Preset Speeds

The ACH 500 allows for seven (7) programmable preset speeds to be selected from the digital inputs. This capability is valuable in a wide range of HVAC applications. One of the seven preset speeds is also used as a fault speed in case of an internal serial communication fault or loss of analog input signal.

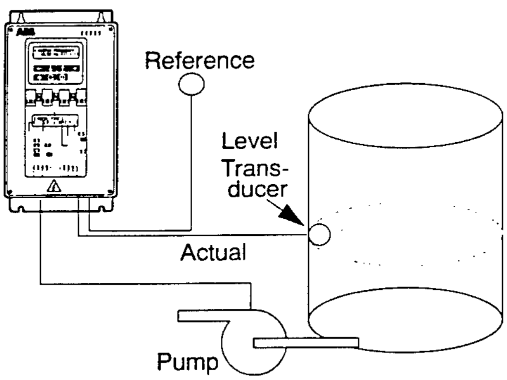
DRIVE FEATURES - CONTROL (cont'd)

■ Proportional Integral (PI) Setpoint Controller

An integral PI Controller with twelve (12) programmable parameters is standard in the ACH 500. These can then be configured to control speed, pressure, flow, fluid level, or other process parameters for maximum efficiency and optimum building control.

The PI controller allows the ACH 500 to maintain a certain process variable - such as flow or pressure - by constantly adjusting the output frequency. Instead of applying a speed reference to the ACH 500, a Process Reference (Setpoint) is applied. An Actual Signal (Feedback) is brought back to the ACH 500.

The ACH 500 compares the two signals, and adjusts the output frequency up or down to cause the difference between the Reference and Actual signals to be as small as possible.



■ Pump & Fan Control

Pump & Fan control is similar to the PI-control above, with the added ability to sequence additional pumps on/off to keep up with the system demand; this feature can eliminate the need for a PLC or pump sequencer.

■ Resolution - 0.01 Hz Frequency

Since the ACH 500 uses digital technology, the output frequency can be adjusted from 0 to 120 Hz in 0.01 Hz increments.

■ Slip Compensation

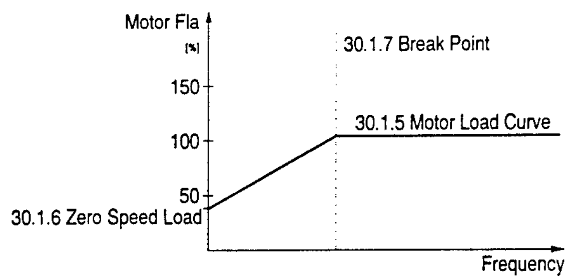
This parameter in the ACH 500 acts to minimize motor slip under varying loads. For example, a squirrel-cage motor will slip under load. This slip can be compensated for by increasing the frequency as the current increases. By activating this parameter, the slip will be automatically reduced down to within approximately 10% or better of the original value.

■ Smart Motor Overload

The "smart" motor overload feature of the ACH 500 is designed to take into account the thermal characteristics of the AC motor. When this function is activated, it may be set to provide a warning (indication on display or digital output changing states) or a fault (same as warning, but drive stops).

This flexible function allows the ACH 500 to calculate motor thermal rise based on the time of an overload, the output frequency, and the current drawn by the motor from the drive. This motor temperature rise is calculated using the following assumptions:

- 104 F (40 C) is the ambient motor operating temperature.
- The motor is at ambient when power is applied.
- The motor cooling time is four times greater when stopped than when running
- At low speeds, the cooling capability of the motor is drastically reduced when a fan driven by the motor shaft is used. The rate of heating and cooling is based on the motor's thermal time constant (default settings for typical motors are provided).



The operation curve can be completely customized to protect motors within any rated speed range.

■ Stall Protection

The ACH 500 provides protection against a stalled motor. When activated, this function can provide a warning or a fault condition caused by excessive motor current at low speeds. The stall current limit can be adjusted from 0 to 1.5 times the ACH 500's I_N rating. The stall frequency/time is also adjustable.

■ Start/Stop Functions

Various Start/Stop control alternatives are accommodated by the design of the ACH 500, all aimed at increasing efficiency of operation and ease of customization for specific applications.

DRIVE FEATURES - CONTROL (cont'd)

Motor starting torque of 180% of the rated torque can be achieved by selecting Start with torque boost. This avoids oversizing the drive and guarantees reliable starting of even the heaviest loads. (Note - The ACH 500 is designed to operate NEMA design B motors with a ratio of breakdown torque to rated torque of 2.6 to 2.9.)

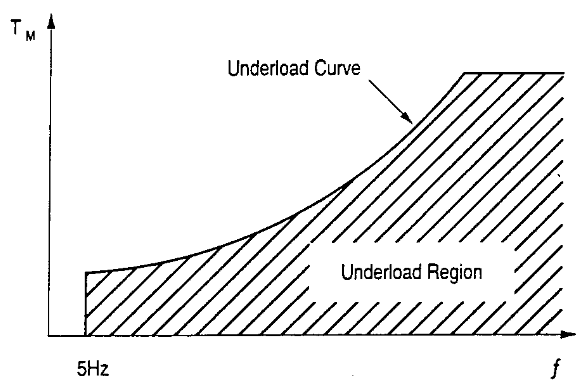
■ Flying Start

The Flying Start function allows the ACH 500 to match its output frequency to the rotational speed of a rotating motor. The ACH 500 is able to smoothly resume operation without forcing the motor to zero speed before accelerating.

■ Underload Function

The ACH 500 offers choices for five (5) Underload Curves and an Underload Time. By selecting the proper torque, frequency, and time parameters, the built-in protection function will then be activated if:

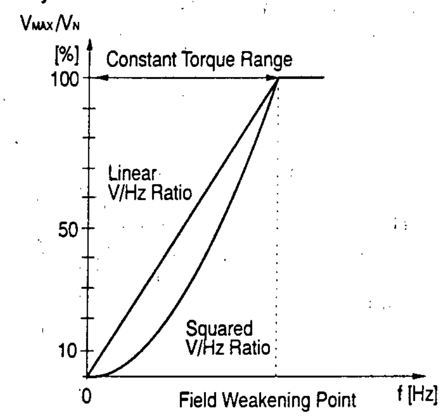
- The motor torque drops below the selected load curve
- The condition has lasted longer than the selected time
- The output frequency is more than the 5Hz. This feature is useful to indicate when a pump goes dry, or a belt breaks.



■ V/Hz (volts per hertz) Shape Control

This parameter allows for the setting of the voltage to frequency relationship in the region below the Field Weakening Point. Three settings are available which are intended to minimize noise, motor losses, and to maximize efficiency:

- **Linear** - The voltage of the motor changes linearly with frequency.
- **Squared** - The voltage of the motor varies as the square of the frequency applied by the drive, to the AC motor. Squared V/Hz is normally used in applications where the load torque characteristics are proportional to the square of the speed, such as centrifugal pumps, fans and compressor drives (variable torque). (Appropriate for single motor applications). Considering the energy saving nature of this function, it is appropriate in lightly loaded applications.
- **Automatic** - The motor voltage is automatically controlled to minimize motor current. This setting is suitable for a single motor constant torque drive system with slow changes in system load.

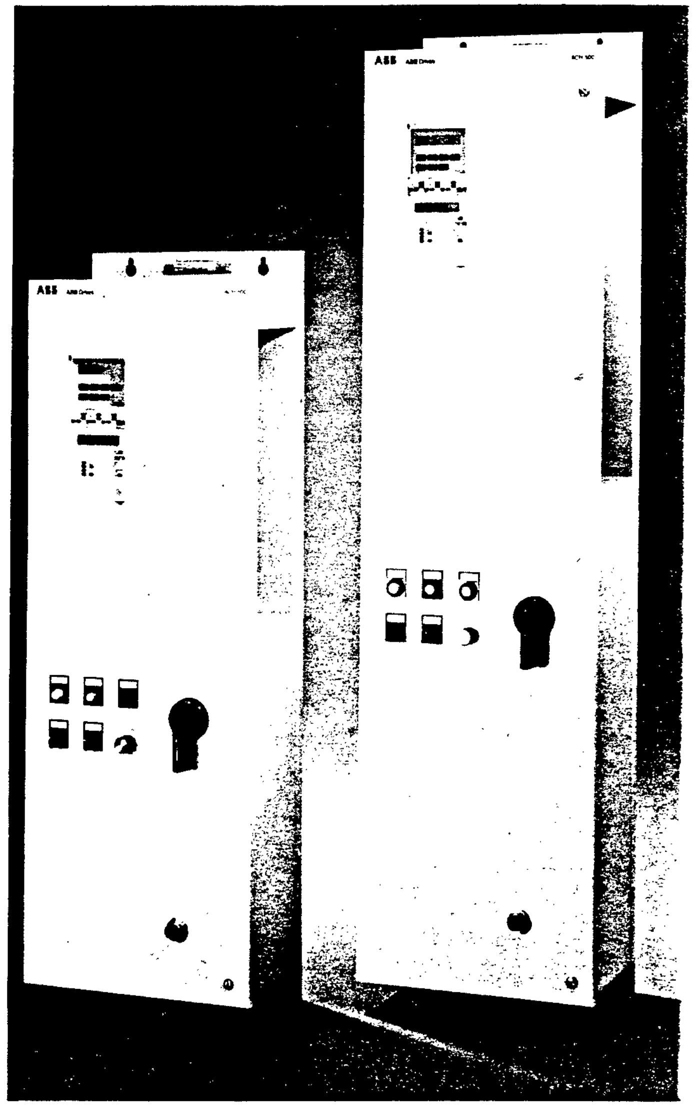


■ Supervisions

The supervision functions are a unique feature of the ACH 500 which allow the drive to monitor the frequency, reference or current, and give an indication if the value of that parameter goes above or below a value which is programmed by the user.

Two frequency limits, one current, and two reference limits can be monitored, and all can be set to indicate either a high limit or low limit. The supervision message will appear on the display, and can also be output through the relay outputs.

OPTIONAL FEATURES



■ 3 to 15 PSI Speed Input

Option board with pressure to electrical transducer to accept a 3 to 15 PSI pneumatic signal as a speed reference for the ACH 500. Also included on this board are two isolators for the digital inputs, allowing them to accept a voltage (24 to 250 VAC or VDC) to activate a digital input, such as 115 VAC start signal.

■ OPTION PACK

The Option Pack is the extended enclosure added to ACH 501 units to house the elecro-mechanical options listed below.

The following options require the extended enclosure in ACH 501 units. (See dimension drawing labeled ACH 501 w/Option Pack).

The enclosure rating is determined by the rating that you select from the price table (NEMA 1 or NEMA 12 only).

■ CONTROL

115 VAC Control Transformer & Terminal Board. Terminal Board for convenient connection of all field control wiring, including all drive inputs and outputs. Includes 115 VAC Start input. Control voltage for start and safety interlocks is 115 VAC.

Also includes 150 VA control transformer, and terminals for field use (approximately 100 VA available).

■ INPUT OPTIONS

Circuit Breaker. Thermal Magnetic Circuit Breaker, thru-the-door interlock type, pad-lockable in the OFF position. (If two MOL's are supplied, the circuit breaker will be a Magnetic Trip Motor Circuit Protector (MCP)). The circuit breaker option is required with bypass in ACH 502 units.

Disconnect Switch. Non-fused disconnect switch, thru-the-door interlock type, pad-lockable in the OFF position. When bypass is supplied (on ACH 501), fuses are supplied with the disconnect switch to provide branch circuit protection for the motor in bypass.

Line Reactor. 3% and 5% impedance line reactors are available to limit the harmonics back to the power line. Reactors are mounted in the option pack on R2 through R5 units, and in the standard enclosure on R6 through R9 units (R8 unit with line reactor will be supplied in the two bay enclosure).

OPTIONAL FEATURES - (cont'd)

■ BYPASS OPTIONS

Manual Bypass. Allows motor to be connected to line power and operate at full speed instead of being powered by the drive. In bypass, the start signals and safety interlocks are still active. Switching to bypass automatically disables the drive.

Motor Overload option may be required to meet local codes.

Control Option B with 115 VAC control transformer is required with all bypass options.

The circuit breaker option is required with bypass in ACH 502 units.

The bypass option includes Normal and Bypass Pilot Lights, and an external fault circuit with an indicating lamp which illuminates when any external safety device has shut down the motor. All pilot lights are push-to-test type.

Manual Bypass With Service Switch. Bypass option as described above with an additional switch which allows power to be removed from the drive for servicing, while the motor operates from line power. Switch is mounted internally to prevent unauthorized persons from disrupting operation.

When bypass is selected, power is removed from the drive.

Automatic Bypass. Automatically transfers motor to line power after the drive trips out on a protective trip. If automatic restart has been enabled on the drive, the drive will attempt to automatically restart before the motor is transferred to line power. (Requires Manual Bypass option).

■ THERMAL OVERLOAD RELAYS:

Motor Overload Relay (MOL). Standard, manually resettable, bimetallic, motor overload relay with Class 20 trip curve provides thermal motor protection when operating from the drive, and across the line with Bypass option. Thru-the-door reset button is included. NOTE: MOL must be sized to the drive for UL Listing.

If two MOL's are required, the Circuit Breaker option must be ordered, and Class 10 adjustable overloads will be supplied. The overload will be sized such that the current rating selected is within the range of adjustment of the overload.

■ Analog Meters

Up to four analog meters can be installed in the extended enclosure. The meters available are: output ammeter (one or two, depending on the number of motors to be driven), output voltmeter, output speedmeter calibrated in % of maximum speed. (Note: one analog output of the drive is used when speed meter supplied).

TECHNICAL DATA

■ Control Connections

The ACH 500 drive can be controlled from its digital control panel or from external control devices. External control devices are connected to either Terminal Block X50 or TB1.

In ACH 501standard units, connections are made to X50. In ACH 501 units with optional extended enclosure, connections are made to TB1. In ACH 502 units, connections are made to TB1.

All parameters are set from the control panel. The following figures show input and output signals of the Control Interface Card and their Connections to the Terminal Block X50 and TB1.

Terminal X50		Function	Factory Settings	Remarks
1	REF	Reference voltage 10 V DC, max 10mA		
2	GND 2	Potentiometer 1KΩ≤ R ≤10KΩ		
3	AI 1+	Analog Input 0 - 10 VDC R=200kW (max)	REFERENCE (AUTO)	10 Bit Resolution
4	AI 1-	0 - 20 mA R=250W (min)		
5	AI 2+	Analog Input 0 - 10 VDC R=200kW (max)	REFERENCE (HAND)	12 Bit Resolution
6	AI 2-	0 - 20 mA R=250W (min)		
7	SPL	Auxiliary voltage output 24 V DC		For field use
8	GND 2	200mA max		
9	N.C.	Not connected		
10	SPL	+24 V max. 10 mA		For Digital Inputs
11	DI 1		START HAND	6 Digital Inputs Programmable via Keypad
12	DI 2		AUTO SELECT	
13	DI 3		PRESET SPEED SEL	
14	DI 4		PRESET SPEED SEL	
15	DI 5		RUN ENABLE	
16	DI 6		START AUTO	
17	AO 1+	Analog Output 0 - 20 mA	Output Frequency	2 Analog Outputs maximum load 500Ω
18	AO 1-			
19	AO 2+	Analog Output 0 - 20 mA	Output Current	
20	AO 2-			
21	RO 11	Relay Output 1	READY	3 Form C Relays
22	RO 12			max. switching voltage 300 VDC/250 VAC
23	RO 13			
24	RO 21	Relay Output 2	RUN	max. switching current 8 A/24 VDC; 0.4 A/250 VDC
25	RO 22			max. switching power 2000 VA/250 VAC
26	RO 23			
27	RO 31	Relay Output 3	FAULT	max. continuous current 2 A
28	RO 32			
29	RO 33			

Terminal X51

1	+8V	Power to remote panel
2	GND2	
3	Shield1	RS-485 Serial Link Connections
4	GND3	
5	SGNA	
6	SGNB	
7	Shield2	

PARAMETER LISTING

Parameter	Alternative Settings	Custom Setting
START-UP DATA		
A LANGUAGE	ENGLISH; GERMAN; ITALIAN; SPANISH; DUTCH; FRENCH; DANISH; FINNISH; SWEDISH	
B APPLICATIONS	HVAC; FLOAT PT; HVAC-PI P&F AUTOM; USER load; USER save	
C APPLIC. RESTORE	NO; YES	
D SUPPLY VOLTAGE	208/220/230/240; 380/400/415; 440/460/480/500	
E USER DISPLAY SCALE	0 – 10000	
F MOTOR CURRENT -FLA	0 A – 1000 A (printed on the motor nameplate)	
G MOTOR POWER hp (kW)	0.7 hp – 1340 hp (0.5 kW – 1000 kW) (printed on the motor nameplate)	
H MOTOR POWER FACTOR	0.1 – 1.0 (printed on the motor nameplate)	
I MOTOR BASE FREQ.	30 Hz – 500 Hz (printed on the motor nameplate)	
J MOTOR BASE R.P.M.	200 RPM – SYNC. SPEED (printed on the motor nameplate)	
K MOTOR NOM. VOLTAGE	110 V – 575 V (printed on the motor nameplate)	
OPERATING DATA		
1 OUTPUT FREQUENCY	Hz	
2 SPEED	RPM; %; USER SCALING	
3 MOTOR CURRENT	A	
4 % RATED TORQUE	%	
5 % RATED POWER	%	
6 DC BUS VOLTAGE	V; % OF RATED NOMINAL	
7 OUTPUT VOLTAGE	V	
8 DRIVE TEMPERATURE	degrees C and F	
9 CONTROL LOCATION	KEYPAD R1; KEYPAD PI; EXTERNAL	
10 KEYPAD REF 1	Hz	
11 KEYPAD PI (REF 2)	%	
12 EXT REF 1 OR 2	REF1/REF2	
13 EXTERNAL REF 1	Hz	
14 EXTERNAL REF 2	%	
15 RUN TIME	h/min	
16 KILOWATT HOURS	kWh	
17 LAST-RECD FAULT	FAULT; WARNING	
18 SECOND-RECD FAULT	FAULT; WARNING	
19 FIRST-RECD FAULT	FAULT; WARNING	
20 PARAMETER LOCK	OPEN xxx; LOCKED xxx; OPEN; LOCKED	
21 APPL BLOCK OUTPUT	%	
22 ACTUAL VALUE 1	%	
23 ACTUAL VALUE 2	%	
24 AUX MOTORS RUNNING	0 – 3	
25 CONTROLLER OUTPUT	%	
26 CONTROL ERROR	%	
27 ACT VALUE 1 (PFC)	Engineering Units	
28 ACT VALUE 2 (PFC)	Engineering Units	
10 CONTROL CONNECTIONS		
10.1 START/STOP/DIRECTION		
10.1.1 EXT 1 STRT/STP/DIR	NOT SEL; DI1; DI1,2; DI1P,2P; DI 1P, 2P, 3; DI1P,2P,3P; DI6; DI6,5; KEYPAD	
10.1.2 EXT 2 STRT/STP/DIR	NOT SEL; DI6; DI6,5; DI1; DI1,2; DI1P,2P; DI 1P, 2P, 3; DI1P,2P,3P; KEYPAD	
10.1.3 LOC/EXT DIRECTION	REVERSE; FORWARD; REQUEST; FAST REV	
10.2 EX REFERENCE SELECT		
10.2.1EXT 1/EXT 2 SELECT	OP DATA 12; DI1; DI2; DI3; DI4; DI5; DI6	
10.2.2 EXTERNAL REF1 SEL	OP DATA 13; AI1; AI2; AI1/JOYST; DI3U,4D; DI3U,4D(R); DI5U,6D	
10.2.3 EXT REF1 MINIMUM	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.2.4 EXT REF1 MAXIMUM	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.2.5 EXTERNAL REF2 SEL	OP DATA 14; AI1; AI2; DI3U,4D; DI3U,4D(R); DI5U,6D	
10.2.6 EXT REF2 MINIMUM	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.2.7 EXT REF2 MAXIMUM	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	

Parameter	Alternative Settings	Custom Setting
10.3 PRESET SPEEDS		
10.3.1 PRESET SPEED SEL	NOT SEL; DI1 – DI6; DI1,2; DI3,4; DI5, 6; DI1,2,3; DI3,4,5; DI4,5,6	
10.3.2 PRESET SPEED 1	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.3.3 PRESET SPEED 2	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.3.4 PRESET SPEED 3	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.3.5 PRESET SPEED 4	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.3.6 PRESET SPEED 5	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.3.7 PRESET SPEED 6	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.3.8 PRESET SPEED 7	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
10.4 SYSTEM CONTR INPUTS		
10.4.1 RUN ENABLE	YES; DI1; DI2; DI3; DI4; DI5; DI6	
10.4.2 FAULT RESET SELECT	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6; ON STOP	
10.4.3 PARAM. LOCK SEL	OP DATA 20; DI1; DI2; DI3; DI4; DI5; DI6	
10.4.4 EXTERNAL FAULT	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6	
10.5 ANALOG INPUTS		
10.5.1 MINIMUM AI1	0 V/0 mA; 2 V/4 mA; READ INPUT	
10.5.2 MAXIMUM AI1	10 V/20 mA; READ INPUT	
10.5.3 RC FILTER ON AI1	0.1s – 10s	
10.5.4 INVERT AI1	NO; YES	
10.5.5 MINIMUM AI2	0 V/0 mA; 2 V/4 mA; READ INPUT	
10.5.6 MAXIMUM AI2	10 V/20 mA; READ INPUT	
10.5.7 RC FILTER ON AI2	0.1s – 10s	
10.5.8 INVERT AI2	NO; YES	
10.6 RELAY OUTPUTS		
10.6.1 RELAY RO1 OUTPUT 10.6.2 RELAY RO2 OUTPUT 10.6.3 RELAY RO3 OUTPUT	NOT USED; READY; RUN; FAULT; FAULT(-1); FAULT(RST) STALL FLT; MOT OT FLT; OT FAULT; FAULT/WARN; WARNING OT WARNING; REVERSED; EXT. CTRL; REF 2 SEL; PRESET SPD; DC BUS LIM; FREQ 1 LIM; FREQ 2 LIM; CURR LIMIT; REF 1 LIMIT; REF 2 LIMIT; AT SPEED; (P&F AUTOM)	
10.7 ANALOG OUTPUTS		
10.7.1 ANALOG OUTPUT 1	NOT USED; OUT FREQ; MOT SPEED; OUT CURR; MOT TORQ; MOT POWER; V/DC BUS; MOTOR VOLT; REFERENCE; ERROR VAL; PICON OUTP; ACTUAL 1; ACTUAL 2; PICON REF	
10.7.2 SCALE AO1	10% – 1000%	
10.7.3 MINIMUM AO1	0 mA; 4mA	
10.7.4 RC FILTER ON AO1	0.01s – 10s	
10.7.5 INVERT AO1	NO; YES	
10.7.6 ANALOG OUTPUT 2	NOT USED; OUT FREQ; MOT SPEED; OUT CURR; MOT TORQ; MOT POWER; V/DC BUS; MOTOR VOLT; REFERENCE; ERROR VAL; PICON OUTP; ACTUAL 1; ACTUAL 2; PICON REF	
10.7.7 SCALE AO2	10% – 1000%	
10.7.8 MINIMUM AO2	0 mA; 4 mA	
10.7.9 RC FILTER ON AO2	0.01s – 10s	
10.7.10 INVERT AO2	NO; YES	
20 DRIVE PARAMETERS		
20.1 FREQ/CURRENT LIMITS		
20.1.1 MINIMUM FREQUENCY	0 Hz – MAX. FREQ.	
20.1.2 MAXIMUM FREQUENCY	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.1.3 FREQUENCY RANGE	0 Hz – 120 Hz; 0 Hz – 500 Hz (ACH 501 only)	
20.1.4 CURRENT LIMIT	0.5 – 2.0 x I_N (ACH 500)	
20.2 START/STOP		
20.2.1 START FUNCTION	RAMP; FLYING; TORQ BOOST; FLYING+TQB	
20.2.2 TORQUE BOOST CURR	0.5 – 2.0 x I_N (ACH 500)	
20.2.3 STOP FUNCTION	COAST; RAMP; DC BRAKE	
20.2.4 BRAKE CHOPPER	NO; YES	
20.2.5 DC HOLD	OFF; ON	
20.2.6 DC HOLD VOLTAGE	0.01 – 0.1 x V_N	
20.2.7 DC BRAKE VOLTAGE	0.01 – 0.1 x V_N	
20.2.8 DC BRAKE TIME	0s – 250s	
20.3 ACCEL/DECEL		
20.3.1 ACC/DEC 1 0R 2 SEL	NOT SEL; DI1; DI2; DI3; DI4; DI5; DI6	
20.3.2 ACC/DEC RAMP SHAPE	LINEAR; S1; S2; S3	

Parameter	Alternative Settings	Custom Setting
20.3.3 ACCEL TIME 1	0.1s – 1800s	
20.3.4 DECEL TIME 1	0.1s – 1800s	
20.3.5 ACCEL TIME 2	0.1s – 1800s	
20.3.6 DECEL TIME 2	0.1s – 1800s	
20.3.7 ACCEL REF2 TIME	0.1s – 1800s	
20.3.8 DECEL REF2 TIME	0.1s – 1800s	
20.4 MOTOR CONTROL		
20.4.1 SWITCHING FREQ	1.0 kHz – 12.0 kHz (ACH 501); 3.0 kHz (ACH 502)	
20.4.2 MAX OUTPUT VOLTAGE	0.15 – 1.05 x V_N	
20.4.3 V/HZ RATIO	LINEAR; SQUARED; AUTOMATIC	
20.4.4 FIELD WEAK POINT	30 Hz – 500 Hz	
20.4.5 IR COMPENSATION	NO; MANUAL; AUTOMATIC	
20.4.6 IR COMP VOLTAGE	0.01 – 0.15 x V_N	
20.4.7 IR COMP RANGE	0 Hz – FWP	
20.4.8 SLIP COMPENSATION	OFF; ON	
20.4.9 NOMINAL SLIP	0.1% – 10%	
20.4.10 VOLTAGE LIMIT	OFF; ON	
20.5 CRITICAL FREQUENCIES		
20.5.1 CRIT FREQ SELECT	OFF; ON	
20.5.2 CRIT FREQ 1 LOW	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.3 CRIT FREQ 1 HIGH	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.4 CRIT FREQ 2 LOW	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.5 CRIT FREQ 2 HIGH	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.6 CRIT FREQ 3 LOW	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.7 CRIT FREQ 3 HIGH	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.8 CRIT FREQ 4 LOW	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.9 CRIT FREQ 4 HIGH	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.10 CRIT FREQ 5 LOW	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
20.5.11 CRIT FREQ 5 HIGH	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
30 PROTECTION/INFORMAT		
30.1 FAULT FUNCTION		
30.1.1 SERIAL FAULT FUNC	STOP; PRE SPEED7	
30.1.2 AI <MIN FUNCTION	NO; WARNING; FAULT; PRE SPEED7	
30.1.3 MOT TEMP FLT FUNC	NO; WARNING; FAULT	
30.1.4 MOTOR THERM TIME	300s – 10000s	
30.1.5 MOTOR LOAD CURVE	50% – 150%	
30.1.6 ZERO SPEED LOAD	40% – MOTOR LOAD CURVE	
30.1.7 BREAK POINT	1 Hz – 500 Hz	
30.1.8 STALL FUNCTION	NO; WARNING; FAULT	
30.1.9 STALL CURRENT	0 – 1.5 x I_N	
30.1.10 STALL TIME/FREQ	10s/15 Hz; 20s/25 Hz; 30s/35 Hz	
30.1.11 UNDERLOAD FUNC	NO; WARNING FAULT	
30.1.12 UNDERLOAD TIME	0 – 600s	
30.1.13 UNDERLOAD CURVE	1 – 5	
30.2 AUTOMATIC RESET		
30.2.1 NUMBER OF RESETS	0 – 5	
30.2.2 TIME WINDOW	1s – 180s	
30.2.3 TIME BETW. RESET ATTEMPTS	0s – 120s	
30.2.4 OVERVOLTAGE	NO; YES	
30.2.5 UNDERVOLTAGE	NO; YES	
30.2.6 OVERCURRENT	NO; YES	
30.2.7 AI SIGNAL <MIN	NO; YES	
30.3 SUPERVISION		
30.3.1 OUTPUT FREQ 1 FUNC	NO; LOW LIMIT; HIGH LIMIT	
30.3.2 OUTPUT FREQ 1 LIM	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
30.3.3 OUTPUT FREQ 2 FUNC	NO; LOW LIMIT; HIGH LIMIT	
30.3.4 OUTPUT FREQ 2 LIM	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
30.3.5 CURRENT FUNCTION	NO; LOW LIMIT; HIGH LIMIT	
30.3.6 CURRENT LIMIT	0 – 2 x I_N (ACH 500)	
30.3.7 REF1 FUNCTION	NO; LOW LIMIT; HIGH LIMIT	
30.3.8 REF1 LIMIT	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	

Parameter	Alternative Settings	Custom Setting
30.3.9 REF2 FUNCTION	NO; LOW LIMIT; HIGH LIMIT	
30.3.10 REF2 LIMIT	0% – 100%	
30.3.11 SUPERVIS MESSAGES	OFF; ON	
30.4 INFORMATION		
30.4.11 CRI PROG VERSION	(Version in Drive)	
30.4.2 MC PROG VERSION	(Version in Drive)	
30.4.3 TEST DATE	(Date Tested)	
40 APPLICATION PARAMETERS	(CAN BE SEEN ONLY WITH APPLICATION MACROS)	
40.1 PI-CONTROL	(CAN BE SEEN ONLY WITH PI-CONTROL MACRO)	
40.1.1 PI-CONT GAIN	3% – 800%	
40.1.2 PI-CONT I-TIME	0.02s – 320s	
40.1.3 PI-CONT MIN LIMIT	0 Hz – PI-CONT MAX LIMIT	
40.1.4 PI-CONT MAX LIMIT	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
40.1.5 ERROR VALUE INVERT	NO; YES	
40.1.6 ACTUAL VALUE SEL	ACT1; ACT1-ACT2; ACT1+ACT2; ACT1*ACT2	
40.1.7 ACTUAL 1 INPUT	AI1; AI2	
40.1.8 ACTUAL 2 INPUT	AI1; AI2	
40.1.9 ACT 1 MIN SCALE	-1600.0% – 1600.0%	
40.1.10 ACT 1 MAX SCALE	-1600.0% – 1600.0%	
40.1.11 ACT 2 MIN SCALE	-1600.0% – 1600.0%	
40.1.12 ACT 2 MAX SCALE	-1600.0% – 1600.0%	
40.2 PUMP & FAN CONTROL	(CAN BE SEEN ONLY WITH P&F AUTOM MACRO)	
40.2.1 PI-CONT GAIN	3% – 800%	
40.2.2 PI-CONT I-TIME	0.1s – 320s	
40.2.3 REFERENCE STEP 1	0% – 100%	
40.2.4 REFERENCE STEP 2	0% – 100%	
40.2.5 REFERENCE STEP 3	0% – 100%	
40.2.6 SLEEP DELAY	0s – 3600s	
40.2.7 SLEEP LEVEL	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
40.2.8 WAKE UP LEVEL	0% – 100%	
40.2.9 START FREQ 1	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
40.2.10 START FREQ 2	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
40.2.11 START FREQ 3	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
40.2.12 LOW FREQ 1	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
40.2.13 LOW FREQ 2	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
40.2.14 LOW FREQ 3	0 Hz – 500 Hz (ACH 501); 0 Hz – 120 Hz (ACH 502)	
40.2.15 LAG MOT START DLY	0s – 3600s	
40.2.16 LAG MOT STOP DLY	0s – 3600s	
40.2.17 NBR OF LAG MOTORS	0 – 3	
40.2.18 ALTERNATION INTERV	0h – 168h	
40.2.19 ALTERNATION LEVEL	0% – 100%	
40.2.20 INTERLOCKS	OFF; ON	
40.2.21 ERROR VALUE INV	NO; YES	
40.2.22 ACTUAL 1 INPUT	NO; AI1; AI2	
40.2.23 ACTUAL 2 INPUT	NO; AI1; AI2	
40.2.24 ACTUAL VALUE SEL	ACT1; ACT1-ACT2; ACT1+ACT2; ACT1*ACT2; min(A1,A2); max(A1,A2); sqrt(ACT1); sqA1+sqA2	
40.2.25 ACT 1 MIN SCALE	-1600.0% – 1600.0%	
40.2.26 ACT 1 MAX SCALE	-1600.0% – 1600.0%	
40.2.27 ACT 2 MIN SCALE	-1600.0% – 1600.0%	
40.2.28 ACT 2 MAX SCALE	-1600.0% – 1600.0%	
40.2.29 REGUL BYPASS	OFF; ON	
40.2.30 DISPLAY UNIT	NO UNIT; bar; %; m/s; C; Pa; 1/min; m^3/min; gpm;psi	
40.2.31 DISPL UNIT SCALE	0 – 50000	
40.2.32 NBR OF DECIMALS	0 – 5	

ORDERING INFORMATION

ACH 501 - 003- 4 - 0 0 P 2

Construction
1 = Sizes 002 to 075, Wall Mounted
2 = Sizes 060 to 400, Std Floor Stand Cabinet
4 = Sizes 060 to 400, Module

Output Power (HP, Constant Torque)

Input Voltage
2 = 208-240 VAC
3 = 380-415 VAC
4 = 440-500 VAC

Internal Option 2
0 = No Option

Internal Option 1
9 = 3-15 PSI and (2) Isolated Digital Inputs (SNAT 762 PSI)
0 = No Option

Control Panel
P = Internal Control Panel SNAT 758 PAN (Keypad and Display)

Enclosure Type*
0 = Chassis (IP 00)
2 = NEMA 1 (IP 21)
3 = NEMA 1 w/Air Filters
5 = NEMA 12 (IP 54)

*Not all Enclosure Types are available for all units.

ORDERING INFORMATION - (Cont'd)

480 VAC	Variable Torque		■ - Available C/F - Consult Factory				Dimension Reference
	HP	AMPS I_{RSQ}	NEMA 1	NEMA12* (see note)	NEMA 1 w/filters	CHASSIS	
ACH501-003-4	3	4.8	■	■‡	N/A	◆	R2 wall
ACH501-005-4	5	7.6	■	■‡	N/A	◆	mounted
ACH501-007-4	7.5	11	■	■‡	N/A	◆	
ACH501-010-4	10	14	■	■	N/A	◆	R3
ACH501-015-4	15	21	■	■	N/A	◆	
ACH501-020-4	20	27	■	■	N/A	◆	R4
ACH501-025-4	25	34	■	■	N/A	◆	
ACH501-030-4	30	40	■	■	N/A	◆	R5
ACH501-040-4	40	52	■	■	N/A	◆	
ACH501-050-4	50	65	■	■	N/A	◆	
ACH501-060-4	60	77	■	■	N/A	◆	R5.5
ACH501-075-4	75	96	■	■	N/A	◆	
ACH502-060-4	60	77	■	C/F	■	■	R6 floor
ACH502-075-4	75	96	■	C/F	■	■	mounted
ACH502-100-4	100	124	■	C/F	■	■	
ACH502-125-4	125	156	■	C/F	■	■	R7
ACH502-150-4	150	180	■	C/F	■	■	
ACH502-200-4	200	240	■	C/F	■	■	R8
ACH502-250-4	250	302	■	C/F	■	■	
ACH502-300-4	300	361	■	C/F	■	■	R9
ACH502-350-4	350	414	■	C/F	■	■	
ACH502-400-4	400	460	■	C/F	■	■	

NOTE: *NEMA 12 units are derated to 35°C unless oversized 1 rating. ◆ - use NEMA 1
‡ - R2 NEMA 12 units do not have HOA switch or speed pot on the standard unit.

230 VAC	Variable Torque		■ - Available		Dimension Reference
	HP	AMPS I_{RSQ}	NEMA 1	NEMA 12* (see note)	
ACH501-002-2	2	7.5	■	■‡	R2 wall
ACH501-003-2	3	10.6	■	■‡	mounted
ACH501-005-2	5	16.8	■	■	R3
ACH501-007-2	7.5	24.2	■	■	
ACH501-010-2	10	30.9	■	■	R4
ACH501-015-2	15	46.	■	■	
ACH501-020-2	20	59.4	■	■	R5
ACH501-025-2	25	74.8	■	■	

Note: ‡ - R2 NEMA 12 units do not have HOA switch or speed pot on the standard unit.

ORDERING INFORMATION - (Cont'd)

ACH501-002-4-00P2
S501002400P2 _ _ _ _ _ _ _

Controls
- B=Hand-Off-Auto Switch & Speed Pot incl. 115V Control Transformer
- 0=None

Extended Enclosure & Input Options*
- A=Door Interlocked Disconnect Switch
- B=Door Interlocked Circuit Breaker
- C=Disconnect w/3% Line Reactor**
- D=Circuit Breaker w/3% Line Reactor**
- E=Input Terminal Block w/3% Line Reactor**
- F=Disconnect w/5% Line Reactor**
- G=Circuit Breaker w/5% Line Reactor**
- H=Input Terminal Block w/5% Line Reactor**
- 0=Extended Enclosure w/Input Terminal Block

*-One of these options must be selected
**-See page 8 for prices.

Bypass
- A=Manual Bypass
- B=Manual Bypass w/Service Switch
- C=Automatic Bypass
- D=Automatic Bypass w/Service Switch
- 0=None

All bypass options require the Control Option B listed above.

Meters
- A=Analog Voltmeter
- B=Analog Speed Meter
- Y=Ammeter (Sized to unit)
- Z=Two Ammeters (Sized to MOL's)
- 1=A+B
- 2=A+Y
- 3=A+Z
- 4=B+Y
- 5=B+Z
- 6=A+B+Y
- 7=A+B+Z
- 0=None

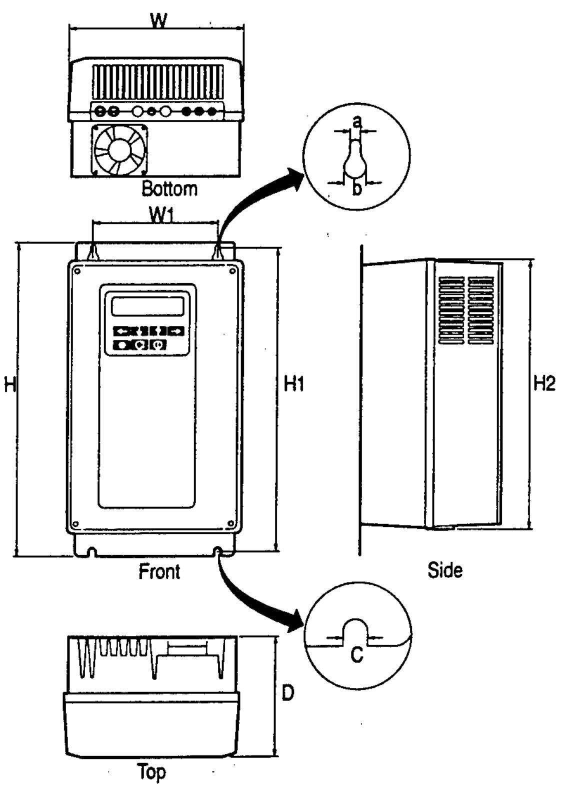
MOL

HP*	ACH 501	HP*	ACH 502
	A=1.41 to 1.58		A=29.3 to 32.0
1	B=1.75 to 1.85	25	B=32.1 to 34.9
	C=2.76 to 2.95		C=35.0 to 37.8
	D=2.96 to 3.21	30	D=37.9 to 41.7
2	E=3.22 to 3.48		E=41.8 to 45.9
	F=3.49 to 3.89		F=46.0 to 49.0
	G=3.90 to 4.35	40	G=49.1 to 54.2
	H=4.36 to 4.73		H=54.3 to 60.0
3	J=4.74 to 5.21		J=57.1 to 62.8
	K=6.47 to 6.95	50	K=62.9 to 69.1
5	L=6.96 to 8.09		L=69.2 to 75.0
	M=8.10 to 9.29	60	M=75.1 to 83.3
	N=9.30 to 10.4		N=83.4 to 86.9
7.5	P=10.5 to 10.9		P=87.0 to 92.9
10	Q=12.1 to 14.5	75	Q=93.0 to 100
	R=14.6 to 16.8		R=98 to 107.9
	S=16.9 to 18.4		S=108 to 113.9
15	T=18.5 to 20.9	100	T=114 to 125.9
	U=22.6 to 24.3		U=126 to 138.9
20	V=24.4 to 27.2		V=139 to 153
	W=29.3 to 32.0	125	W=154 to 163
25	X=32.1 to 34.9		X=164 to 180
	Y=35.0 to 37.8	150	Y=175 to 194
30	Z=37.9 to 41.7		Z=195 to 220
	2=46.0 to 49.0	200	2=221 to 247
40	3=49.1 to 54.2		3=248 to 276
	4=57.1 to 62.8	250	4=277 to 307
50	5=62.9 to 69.1		5=308 to 345
	6=69.2 to 75.0	300	6=346 to 381
	7=83.4 to 86.9	350	7=382 to 420
	8=87.0 to 92.9		8=421 to 465
	9=93.0 to 100		0=None
	0=None		

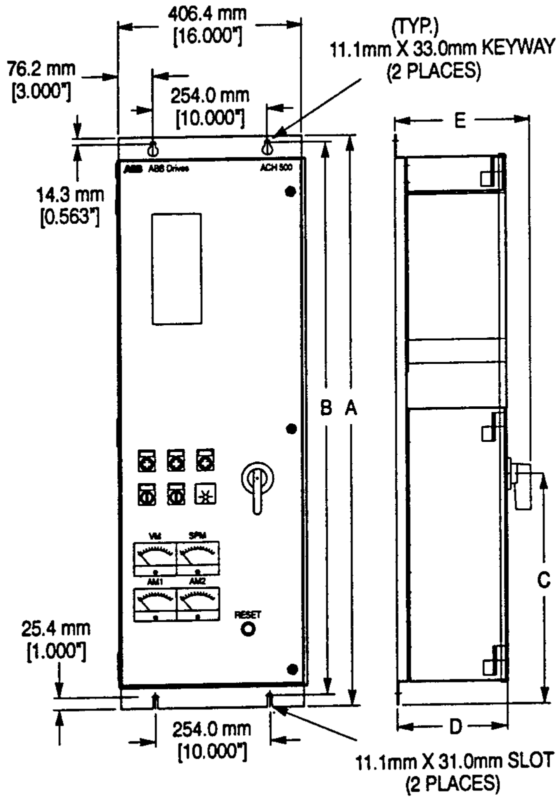
* Horsepowers listed are estimated only for 460 volts. MOL's MUST be sized for the specific motor. Horsepowers for 230 V are half the horsepower at 460 V.

DIMENSIONS
ACH 501

Dimensions	R2		R3		R4		R5		R5.5	
	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm
W	7-7/8	200	9-55/64	250	11-13/16	300	13-13/16	351	13-13/16	351
W1	5-29/32	150	6-57/64	175	8-55/64	225	10-27/32	275	10-27/32	275
H	14-17/64	362	16-3/4	425	19-31/32	507	23-3/4	603	23-3/4	603
H1	13-25/32	350	15-3/4	400	18-29/32	480	22-41/64	575	22-41/64	575
H2	12-9/32	312	14-31/32	380	18-7/64	460	21-45/64	551	21-45/64	551
D	7-25/64	188	8-3/16	208	9-13/16	249	10-5/16	262	12-1/16	307
a	15/64	7	5/16	9	5/16	9	5/16	9	5/16	9
b	35/64	14	45/64	18	45/64	18	45/64	18	45/64	18
c	15/64	7	5/16	9	5/16	9	5/16	9	5/16	9
Unit Weight	17 lbs	8 kg	31 lbs	14 kg	54 lbs	25 kg	74 lbs	34 kg	88 lbs	40 kg
Shipping Weight	20 lbs	9 kg	34 lbs	15 kg	60 lbs	27 kg	80 lbs	36 kg	96 lbs	44 kg



DIMENSIONS
ACH 501 w/Option Pack

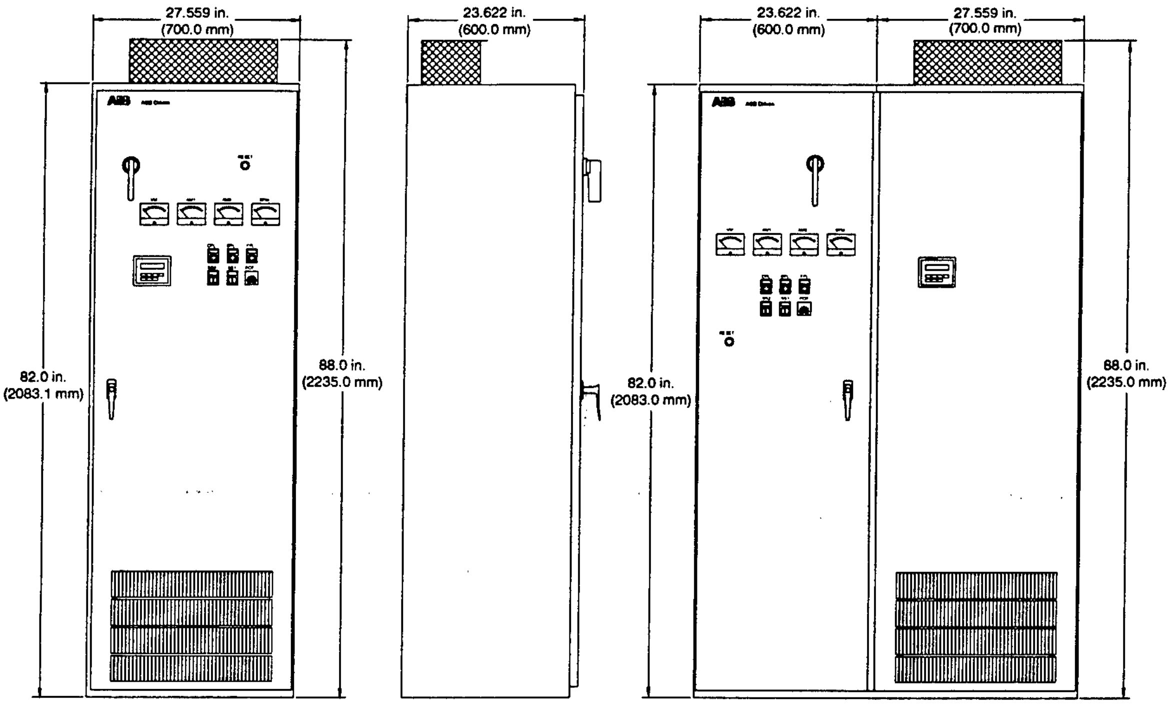


	R2 & R3		R4 & R5		R5.5	
	mm	in.	mm	in.	mm	in.
A	1270.0	50.0	1651.0	65.0	1727.2	68.0
B	1230.3	48.4	1611.3	63.6	1687.5	66.6
C	510.2	20.1	675.3	26.6	809.5	31.9
D	240.2	9.5	298.0	11.7	343.0	13.5
E	292.4	11.5	350.2	13.8	395.2	15.6

Note: 230 volt 20 HP C.T./25 HP V.T. w/Bypass is R5.5 size optionpack.

Drive Type	With Disconnect		With Bypass	
	lbs	Kg	lbs	Kg
R2	95	43.1	106	48.1
R3	107	48.5	118	53.5
R4	158	71.7	170	77.1
R5	176	79.8	198	89.8
R5.5	198	89.8	235	106.6

DIMENSIONS
ACH 502 (480 VAC)



FRONT
R6 & R7 - all units
R8 without bypass

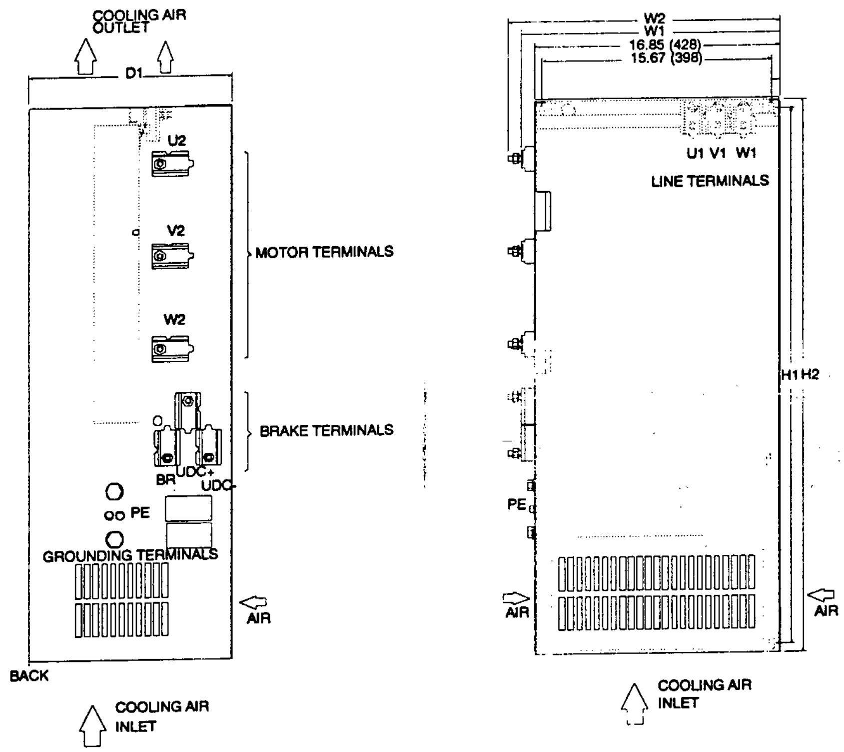
LEFT SIDE

FRONT
R8 with bypass
R9 - all units

380 volt Dimensions	R6		R7		R8		R9	
	mm	in	mm	in	mm	in	mm	in
H	1800	70.9	1800	70.9	2090	82.3	2215	87.2
W	800	31.5	800	31.5	800	31.5	856	33.7
D	470	18.5	470	18.5	470	18.5	636	25.0
Weight	210	463	245	540	315	695	345	761

Weights (480 VAC)	With Disconnect				With Bypass			
	UNIT		SHIP		UNIT		SHIP	
Drive Type	lbs	Kg	lbs	Kg	lbs	Kg	lbs	Kg
R6	510	231	560	254	555	252	605	274
R7	580	263	630	286	660	299	710	322
R8	650	295	700	318	1025	465	1125	510
R9	1000	454	1100	499	1200	544	1300	590

DIMENSIONS
ACH 504



Code	R6		R7		R8		R9	
	mm	in	mm	in	mm	in	mm	in
H1	675	26.57	959	37.76	1255	49.41	1608	63.31
H2	705	27.76	989	38.94	1285	50.59	1638	64.49
W1	451	17.76	451	17.76	482	18.98	482	18.98
W2	473	18.62	473	18.62	512	20.16	512	20.16
D1	385	15.28	385	15.28	415	16.34	415	16.34

	R6	R7	R8	R9
Weight (lb)	137	196	278	364
Weight (kg)	62	89	126	165

Note: The control unit (consisting of the keypad/display and control interface board) included with the ACH 504 drive is not shown in the dimensional drawing above. The control interface may be mounted to the door of the enclosure that the ACH 504 is mounted in or inside the enclosure.

NOTES

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APPENDIX K

Carrier HAP Program Data

APPENDIX K
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DESIGN WEATHER PARAMETERS & MSHGs

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DESIGN PARAMETERS

City Name......................:	Hawthorne
Location.......................:	Nevada
Latitude.......................:	38.5 degrees
Longitude......................:	118.7 degrees
Elevation......................:	4186.0 ft
Summer Design Dry-Bulb............:	97.0 F
Summer Coincident Wet-Bulb........:	62.0 F
Summer Daily Range................:	36.0 F
Winter Design Dry-bulb............:	7.0 F
Atmospheric Clearness Number......:	1.10
Average Ground Reflectance........:	0.20
Soil Conductivity.................:	0.800 BTU/hr/ft/F
Local Time Zone (GMT +/- N hours).:	8.0 hours
Consider Daylight Savings Time....?	N
First Month for Daylight Savings..:	-
Last Month for Daylight Savings...:	-
Simulation Weather Data...........:	Reno (TMY)
Current data is...................:	User Defined

DESIGN DAY MAXIMUM SOLAR HEAT GAINS (BTU/HR/SQFT)

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S
January	22.2	22.2	22.2	97.5	166.0	233.9	264.8	278.3	277.5
February	27.0	27.0	57.0	144.8	215.1	254.8	275.2	268.8	260.3
March	32.1	32.1	115.2	184.6	240.0	265.0	257.7	235.0	219.2
April	37.4	79.9	154.6	215.9	244.3	245.7	217.8	180.5	160.4
May	41.0	115.8	177.3	226.9	242.8	224.8	187.3	137.2	114.6
June	51.1	127.6	186.1	228.9	237.9	214.9	171.8	118.8	95.6
July	41.9	113.3	178.4	223.8	236.0	221.4	181.2	134.2	110.3
August	39.2	76.6	152.1	208.3	233.1	237.8	209.8	174.9	154.6
September	33.5	33.5	105.9	177.7	223.7	252.9	245.5	226.0	214.0
October	28.0	28.0	59.4	136.2	204.0	249.9	264.0	259.0	253.6
November	22.7	22.7	22.7	90.4	171.5	223.5	264.1	274.7	274.5
December	20.1	20.1	20.1	77.0	147.2	218.5	256.5	276.2	277.8

Month	SSW	SW	WSW	W	WNW	NW	NNW	HOR	Mult.
January	279.3	267.6	231.5	171.9	96.3	22.2	22.2	153.9	1.00
February	268.5	274.9	258.3	214.9	136.7	62.8	27.0	204.7	1.00
March	234.6	257.0	265.3	238.4	186.8	114.7	32.1	249.2	1.00
April	181.9	218.7	247.0	242.0	214.7	157.5	74.2	279.8	1.00
May	138.8	185.8	227.2	239.2	227.8	182.1	111.6	293.5	1.00
June	119.7	170.7	216.0	236.7	229.5	188.1	126.2	295.0	1.00
July	134.0	181.4	221.3	236.3	223.8	178.0	113.8	289.0	1.00
August	175.5	210.9	238.1	233.3	207.6	152.9	74.0	274.2	1.00
September	227.4	248.5	249.4	229.6	174.7	105.5	33.5	242.2	1.00
October	259.1	263.2	249.1	201.1	140.8	53.3	28.0	202.1	1.00
November	271.5	261.7	229.8	168.8	92.1	22.7	22.7	154.5	1.00
December	274.4	256.4	219.0	151.4	75.3	20.1	20.1	132.2	1.00

Mult. = User-defined solar multiplier factor.

Note: The following Carrier HAP program input and output data represents building heating, ventilating and air conditioning (HVAC) energy use for selected WADF buildings. Computerized weather data required for the HAP program is available for selected cities; Hawthorne data is not computerized. Thus, computerized data available for Reno, Nevada, is used. Results of the HVA energy use simulations are adjusted for Hawthorne based on the heating and cooling degree days for Reno and for Hawthorne, Nevada, as reported in TM 5-785 Engineering Weather Data.

COOLING DESIGN TEMPERATURE PROFILES

ation: Hawthorne, Nevada 12-20-94

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(Format is Dry-Bulb/Wet-Bulb F)

	January	February	March	April	May	June
0	23.5/ 16.4	27.5/ 22.8	38.5/ 33.9	48.5/ 39.0	57.5/ 45.4	64.5/ 49.1
)0	21.7/ 15.1	25.7/ 21.5	36.7/ 32.9	46.7/ 38.2	55.7/ 44.6	62.7/ 48.4
)0	19.9/ 13.9	23.9/ 20.4	34.9/ 32.0	44.9/ 37.2	53.9/ 43.8	60.9/ 47.6
)0	18.4/ 12.8	22.4/ 19.4	33.4/ 31.2	43.4/ 36.5	52.4/ 43.1	59.4/ 47.0
)0	17.4/ 12.1	21.4/ 18.8	32.4/ 30.6	42.4/ 35.9	51.4/ 42.6	58.4/ 46.6
)0	17.0/ 11.8	21.0/ 18.5	32.0/ 30.4	42.0/ 35.7	51.0/ 42.5	58.0/ 46.4
)0	17.7/ 12.3	21.7/ 19.0	32.7/ 30.8	42.7/ 36.1	51.7/ 42.7	58.7/ 46.7
)0	19.5/ 13.6	23.5/ 20.2	34.5/ 31.7	44.5/ 37.0	53.5/ 43.6	60.5/ 47.5
)0	22.8/ 15.9	26.8/ 22.3	37.8/ 33.5	47.8/ 38.7	56.8/ 45.1	63.8/ 48.9
)0	27.4/ 19.0	31.4/ 25.1	42.4/ 36.0	52.4/ 40.9	61.4/ 47.1	68.4/ 50.7
)0	32.8/ 22.5	36.8/ 28.2	47.8/ 38.8	57.8/ 43.5	66.8/ 49.3	73.8/ 52.8
)0	39.0/ 26.2	43.0/ 31.6	54.0/ 41.8	64.0/ 46.2	73.0/ 51.8	80.0/ 55.1
)0	44.7/ 29.5	48.7/ 34.7	59.7/ 44.4	69.7/ 48.7	78.7/ 54.0	85.7/ 57.2
)0	49.0/ 31.8	53.0/ 37.0	64.0/ 46.3	74.0/ 50.4	83.0/ 55.6	90.0/ 58.7
)0	51.9/ 33.4	55.9/ 38.5	66.9/ 47.6	76.9/ 51.6	85.9/ 56.6	92.9/ 59.7
)0	53.0/ 34.0	57.0/ 39.0	68.0/ 48.0	78.0/ 52.0	87.0/ 57.0	94.0/ 60.0
00	51.9/ 33.4	55.9/ 38.5	66.9/ 47.6	76.9/ 51.6	85.9/ 56.6	92.9/ 59.7
00	49.4/ 32.0	53.4/ 37.2	64.4/ 46.5	74.4/ 50.6	83.4/ 55.7	90.4/ 58.8
00	45.4/ 29.9	49.4/ 35.1	60.4/ 44.7	70.4/ 49.0	79.4/ 54.3	86.4/ 57.4
00	40.8/ 27.3	44.8/ 32.6	55.8/ 42.6	65.8/ 47.0	74.8/ 52.5	81.8/ 55.8
00	36.1/ 24.5	40.1/ 30.1	51.1/ 40.4	61.1/ 45.0	70.1/ 50.7	77.1/ 54.1
00	32.1/ 22.1	36.1/ 27.8	47.1/ 38.4	57.1/ 43.2	66.1/ 49.1	73.1/ 52.6
00	28.5/ 19.8	32.5/ 25.7	43.5/ 36.6	53.5/ 41.5	62.5/ 47.5	69.5/ 51.2
00	25.6/ 17.8	29.6/ 24.0	40.6/ 35.1	50.6/ 40.1	59.6/ 46.3	66.6/ 50.0

r	July	August	September	October	November	December
00	67.5/ 51.6	67.5/ 51.6	61.5/ 47.9	51.5/ 41.6	41.5/ 33.9	29.5/ 22.7
00	65.7/ 50.9	65.7/ 50.9	59.7/ 47.1	49.7/ 40.7	39.7/ 32.9	27.7/ 21.6
00	63.9/ 50.2	63.9/ 50.2	57.9/ 46.3	47.9/ 39.9	37.9/ 31.9	25.9/ 20.4
00	62.4/ 49.6	62.4/ 49.6	56.4/ 45.7	46.4/ 39.1	36.4/ 31.2	24.4/ 19.5
00	61.4/ 49.2	61.4/ 49.2	55.4/ 45.2	45.4/ 38.6	35.4/ 30.6	23.4/ 18.8
00	61.0/ 49.0	61.0/ 49.0	55.0/ 45.1	45.0/ 38.4	35.0/ 30.4	23.0/ 18.5
00	61.7/ 49.3	61.7/ 49.3	55.7/ 45.4	45.7/ 38.8	35.7/ 30.8	23.7/ 19.0
00	63.5/ 50.0	63.5/ 50.0	57.5/ 46.2	47.5/ 39.7	37.5/ 31.7	25.5/ 20.2
00	66.8/ 51.4	66.8/ 51.4	60.8/ 47.6	50.8/ 41.3	40.8/ 33.5	28.8/ 22.3
00	71.4/ 53.2	71.4/ 53.2	65.4/ 49.5	55.4/ 43.4	45.4/ 36.0	33.4/ 25.1
)00	76.8/ 55.1	76.8/ 55.1	70.8/ 51.7	60.8/ 45.8	50.8/ 38.7	38.8/ 28.3
.00	83.0/ 57.4	83.0/ 57.4	77.0/ 54.0	67.0/ 48.5	57.0/ 41.8	45.0/ 31.6
00	88.7/ 59.3	88.7/ 59.3	82.7/ 56.1	72.7/ 50.8	62.7/ 44.4	50.7/ 34.7
00	93.0/ 60.7	93.0/ 60.7	87.0/ 57.6	77.0/ 52.5	67.0/ 46.3	55.0/ 37.0
00	95.9/ 61.7	95.9/ 61.7	89.9/ 58.6	79.9/ 53.6	69.9/ 47.5	57.9/ 38.5
00	97.0/ 62.0	97.0/ 62.0	91.0/ 59.0	81.0/ 54.0	71.0/ 48.0	59.0/ 39.0
00	95.9/ 61.7	95.9/ 61.7	89.9/ 58.6	79.9/ 53.6	69.9/ 47.5	57.9/ 38.5
00	93.4/ 60.9	93.4/ 60.9	87.4/ 57.8	77.4/ 52.6	67.4/ 46.5	55.4/ 37.2
00	89.4/ 59.5	89.4/ 59.5	83.4/ 56.4	73.4/ 51.1	63.4/ 44.7	51.4/ 35.1
00	84.8/ 58.0	84.8/ 58.0	78.8/ 54.7	68.8/ 49.2	58.8/ 42.6	46.8/ 32.6
)00	80.1/ 56.3	80.1/ 56.3	74.1/ 52.9	64.1/ 47.3	54.1/ 40.4	42.1/ 30.1
00	76.1/ 54.9	76.1/ 54.9	70.1/ 51.4	60.1/ 45.5	50.1/ 38.4	38.1/ 27.9
:00	72.5/ 53.6	72.5/ 53.6	66.5/ 50.0	56.5/ 43.9	46.5/ 36.6	34.5/ 25.8
00	69.6/ 52.5	69.6/ 52.5	63.6/ 48.8	53.6/ 42.6	43.6/ 35.1	31.6/ 24.0

SIMULATION WEATHER DATA SUMMARY

Data: Reno, Nevada (TMY) 12-20-94

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TABLE 1. SIMULATION WEATHER DATA DESIGN PARAMETERS

City.....................................:	Reno
Location.................................:	Nevada
Type of Data.............................:	Typical Meteorological Year
Latitude.................................:	39.5 deg
Longitude................................:	119.8 deg
Elevation................................:	4490.0 ft
* Average Ground Reflectivity..............:	0.20
Local Time Zone (GMT +/- N hours).........:	8.0 hours
* Daylight Savings Time Considered..........?	N

* = User-defined design parameters. All other values are fixed.

TABLE 2. DRY-BULB TEMPERATURE STATISTICS (F)

Month	Absolute Maximum	Average Maximum	Average	Average Minimum	Absolute Minimum
January	55.5	45.8	33.2	23.7	14.0
February	68.4	50.6	36.5	23.6	11.4
March	72.9	57.0	42.8	29.0	19.0
April	72.0	59.8	46.6	33.1	21.5
May	84.9	69.0	54.5	38.4	29.9
June	93.5	79.7	65.4	47.3	39.3
July	98.0	89.9	71.8	52.0	42.7
August	99.0	86.3	68.9	50.2	42.8
September	92.9	79.4	60.5	42.1	23.5
October	83.0	66.8	48.7	32.4	23.4
November	70.0	54.0	39.0	26.5	15.5
December	58.2	41.3	31.6	22.7	-0.4

TABLE 3. DAILY TOTAL SOLAR RADIATION STATISTICS

	[---- Daily Total Solar ---] (BTU/sqft)			[-- Daily Clearness Number --] (Dimensionless)		
Month	Maximum	Average	Minimum	Maximum	Average	Minimum
January	1193.8	849.7	566.7	0.756	0.614	0.378
February	1639.4	1136.6	492.2	0.785	0.614	0.295
March	2282.3	1689.2	898.3	0.815	0.681	0.389
April	2751.2	2077.9	936.7	0.830	0.673	0.288
May	2984.5	2457.1	1239.8	0.826	0.700	0.345
June	3017.3	2725.3	1774.0	0.820	0.740	0.480
July	2958.3	2657.3	1288.6	0.811	0.741	0.358
August	2747.6	2421.3	1816.6	0.797	0.748	0.602
September	2354.4	2012.6	788.8	0.790	0.747	0.310
October	1815.5	1414.4	692.0	0.772	0.687	0.358
November	1297.1	899.5	373.3	0.747	0.597	0.244
December	924.2	678.5	211.7	0.709	0.545	0.172

Notes: * All solar data is daily total flux on a horizontal surface.
* Clearness number is (Daily Total Solar)/(Extraterrestrial Solar)
Values between 0.70 and 0.80 represent clear conditions.

****

WALL TYPE 1: (CUSTOM WALL)

Description...........: Wall 1
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
1/2-in (13 mm) gypsum board	0.50	50.0	0.26	0.45	2.1
Airspace	0.88	0.0	0.00	0.91	0.0
8-in (203 mm) HW concrete	8.00	140.0	0.20	0.67	93.3
Outside surface resistance	-	-	-	0.33	-
Totals	9.38			3.04	95.4

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

WALL TYPE 2: (CUSTOM WALL)

Description...........: Wall 2
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
1/2-in (13 mm) gypsum board	0.50	50.0	0.26	0.45	2.1
R-11 (RSI-1.9) batt insulation	3.50	0.5	0.20	11.22	0.1
12-in (203 mm) HW concrete	12.00	140.0	0.20	1.00	140.0
Outside surface resistance	-	-	-	0.33	-
Totals	16.00			13.68	142.2

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

WALL TYPE 3: (CUSTOM WALL)

Description...........: Wall 3
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
12-in (203 mm) HW concrete	12.00	140.0	0.20	1.00	140.0
Outside surface resistance	-	-	-	0.33	-
Totals	12.00			2.02	140.0

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

WALL TYPE 4: (CUSTOM WALL)

Description...........: Wall 4
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
1-1/4" stucco & tile	1.50	116.0	0.20	0.30	14.5
Board insulation	0.88	2.0	0.22	6.08	0.1
12-in (300 mm) HW concrete	12.00	140.0	0.20	1.00	140.0
Outside surface resistance	-	-	-	0.33	-
Totals	14.38			8.39	154.6

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

WALL TYPE 5: (CUSTOM WALL)

Description..........: Wall 5
Absorptivity.........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
1/2-in (13 mm) gypsum board	0.50	50.0	0.26	0.45	2.1
Airspace	2.50	0.0	0.00	0.91	0.0
12-in (300 mm) HW concrete	12.00	140.0	0.20	1.00	140.0
Outside surface resistance	-	-	-	0.33	-
Totals	15.00			3.38	142.1

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

WALL TYPE 6: (CUSTOM WALL)

Description..........: Wall 6
Absorptivity.........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
8-in (203 mm) HW concrete	8.00	140.0	0.20	0.67	93.3
Outside surface resistance	-	-	-	0.33	-
Totals	8.00			1.68	93.3

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

WALL TYPE 7: (CUSTOM WALL)

Description..........: Wall 7
Absorptivity.........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
10-in (254 mm) HW concrete	10.00	140.0	0.20	0.83	116.7
Outside surface resistance	-	-	-	0.33	-
Totals	10.00			1.85	116.7

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

LL TYPE 8: (CUSTOM WALL)

scription...........: Wall 8
sorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
ıside surface resistance	-	-	-	0.69	-
2-in (13 mm) gypsum board	0.50	50.0	0.26	0.45	2.1
ıtt insulation	0.88	0.5	0.20	2.80	0.0
2-in (13 mm) gypsum board	0.50	50.0	0.26	0.45	2.1
ıtside surface resistance	-	-	-	0.33	-
otals	1.88			4.72	4.2

hickness: in Density: lb/cuft Weight: lb/sqft
-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

LL TYPE 9: (CUSTOM WALL)

escription...........: Wall 9
osorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
nside surface resistance	-	-	-	0.69	-
5-in (406 mm) HW concrete	16.00	140.0	0.20	1.33	186.7
utside surface resistance	-	-	-	0.33	-
otals	16.00			2.35	186.7

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

ALL TYPE 10: (CUSTOM WALL)

escription...........: Wall 10
bsorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
nside surface resistance	-	-	-	0.69	-
2 gage steel deck	0.03	489.0	0.12	0.00	1.4
.-14 (RSI-2.5) board insulation	2.00	2.0	0.22	13.89	0.3
2 gage steel deck	0.03	489.0	0.12	0.00	1.4
utside surface resistance	-	-	-	0.33	-
'otals	2.07			14.91	3.1

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

ROOF TYPE 1: (CUSTOM ROOF)

Description...........: Roof & Ceiling
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
Acoustic Tile	0.75	18.0	0.14	3.73	1.1
Airspace	24.00	0.0	0.00	0.91	0.0
4-in (102 mm) LW concrete	4.00	40.0	0.20	3.33	13.3
Board insulation	3.00	2.0	0.22	20.83	0.5
Built-up roofing	0.38	70.0	0.35	0.33	2.2
Outside surface resistance	-	-	-	0.33	-
Totals	32.13			30.16	17.1

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

ROOF TYPE 2: (CUSTOM ROOF)

Description...........: Roof 2 - 117-3 Frangible Roof 1:12 Slope
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
22 gage steel deck	0.03	489.0	0.12	0.00	1.4
Board insulation	3.00	2.0	0.22	20.83	0.5
Built-up roofing	0.38	70.0	0.35	0.33	2.2
Outside surface resistance	-	-	-	0.33	-
Totals	3.41			22.18	4.1

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

ROOF TYPE 3: (CUSTOM ROOF)

Description...........: Roof 3 - 117-3 Working Corridor (Covered)
Absorptivity..........: 0.200

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
16-in (406 mm) HW concrete	16.00	140.0	0.20	1.33	186.7
Board insulation	3.00	2.0	0.22	20.83	0.5
Built-up roofing	0.38	70.0	0.35	0.33	2.2
Outside surface resistance	-	-	-	0.33	-
Totals	19.38			23.52	189.4

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

ROOF TYPE 4: (CUSTOM ROOF)

Description...........: Roof 4 - 117-3 WCs, Corridor, Offices 1:12 Slope
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
Acoustic Tile	0.75	18.0	0.14	3.73	1.1
Airspace	36.00	0.0	0.00	0.91	0.0
22 gage steel deck	0.03	489.0	0.12	0.00	1.4
Board insulation	3.00	2.0	0.22	20.83	0.5
Outside surface resistance	-	-	-	0.33	-
Totals	39.78			26.49	3.0

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

****

ROOF TYPE 5: (CUSTOM ROOF)

Description...........: Ceiling Partition Toilet Area 117-5
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
1/2-in (13 mm) gypsum board	0.50	50.0	0.26	0.45	2.1
R-11 (RSI-1.9) batt insulation	3.50	0.5	0.20	11.22	0.1
1/2-in (13 mm) plywood	0.50	34.0	0.29	0.62	1.4
Outside surface resistance	-	-	-	0.33	-
Totals	4.50			13.31	3.6

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

ROOF TYPE 6: (CUSTOM ROOF)

Description...........: Roof 6 - 117-5 Work Room & Mechanical Room Roofs
Absorptivity..........: 0.900

Layer Description	Thickness	Density	Spec.Ht	R-Val	Weight
Inside surface resistance	-	-	-	0.69	-
8-in (203 mm) HW concrete	8.00	140.0	0.20	0.67	93.3
Board insulation	3.00	2.0	0.22	20.83	0.5
Built-up roofing	0.38	70.0	0.35	0.33	2.2
Outside surface resistance	-	-	-	0.33	-
Totals	11.38			22.85	96.0

Thickness: in Density: lb/cuft Weight: lb/sqft
R-value : (hr-sqft-F)/BTU Specific Heat: BTU/lb/F

SPACE DESCRIPTION

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GENERAL

- Name......: 1. Wet Lab Office & Hall
- Floor Area......: 237.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING

- Overhead Fixture: Recessed
- Lamp Wattage....: 690.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE

- Occupancy.......: 2 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS

- Equipment.......: 3.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES

- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION

- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR

- Type........:Slab On Grade
- Perimeter.............: 31.2 ft
- Slab Floor Area.......: 237.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	177.8	5	1	0	-	1	0	-	N
E	51.3	5	1	0	-	1	0	-	N
W	51.3	5	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	237.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL

Name......: 2. Test Cell & Fume Hood
Floor Area......: 89.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING

Overhead Fixture: Recessed
Lamp Wattage....: 100.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE

Occupancy.......: 1 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS

Equipment.......: 7.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES

Lighting....: Lights
Task Lights.: Lights
People......: Lights
Equipment...: Lights
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION

Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR

Type........:Slab On Grade
Perimeter.............: 12.5 ft
Slab Floor Area.......: 89.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	83.7	5	1	0	-	1	0	-	N
E	28.8	5	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	89.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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GENERAL

- Name......: 3. Test Cell w/o Hood
- Floor Area......: 73.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING

- Overhead Fixture: Recessed
- Lamp Wattage....: 70.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE

- Occupancy.......: 1 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS

- Equipment.......: 7.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES

- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION

- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR

- Type........:Slab On Grade
- Perimeter.............: 7.9 ft
- Slab Floor Area.......: 73.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	71.1	5	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	73.0	1	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	86.4 sqft	0.0 sqft
U-value...............:	0.329 BTU/hr/sqft/F	0.500 BTU/hr/sqft/F
Maximum Space Temp....:	97.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	55.0 F
Minimum Space Temp....:	45.0 F	75.0 F
Outside Air Temp @ Min:	7.0 F	54.0 F

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****

GENERAL
- Name......: 4. Instrument Lab
- Floor Area......: 550.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 1030.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 4 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 7.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 0.0 ft
- Slab Floor Area.......: 550.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

No external wall or window data for this space.

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	550.0	1	1	0

PARTITION LOADS	Type 1	Type 2
Type.................:	Partition	Ceiling
Area.................:	288.0 sqft	0.0 sqft
U-value..............:	0.296 BTU/hr/sqft/F	0.500 BTU/hr/sqft/F
Maximum Space Temp....:	97.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	55.0 F
Minimum Space Temp....:	45.0 F	75.0 F
Outside Air Temp @ Min:	7.0 F	54.0 F

****

GENERAL
Name......: 5. Biochemical Lab
Floor Area......: 963.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 2750.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 4 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 7.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: Lights
Equipment...: Lights
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 0.0 ft
Slab Floor Area.......: 963.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

==

No external wall or window data for this space.

==

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	963.0	1	1	0

==

No partition data for this space.

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GENERAL
- Name......: 6. Wet Chemistry Lab
- Floor Area......: 137.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 340.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 1 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 7.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 0.0 ft
- Slab Floor Area.......: 137.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

==

No external wall or window data for this space.

==

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	137.0	1	1	0

==

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	72.0 sqft	0.0 sqft
U-value...............:	0.296 BTU/hr/sqft/F	0.010 BTU/hr/sqft/F
Maximum Space Temp....:	97.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	55.0 F
Minimum Space Temp....:	45.0 F	74.0 F
Outside Air Temp @ Min:	7.0 F	54.0 F

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****

GENERAL
Name......: 7. Balance & Oven Room
Floor Area......: 172.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? Y

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 1030.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 2 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 7.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: Lights
Equipment...: Lights
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 0.0 ft
Slab Floor Area.......: 172.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

No external wall or window data for this space.

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	172.0	1	1	0

PARTITION LOADS	Type 1	Type 2
Type.................:	Partition	Ceiling
Area.................:	90.0 sqft	0.0 sqft
U-value..............:	0.296 BTU/hr/sqft/F	0.010 BTU/hr/sqft/F
Maximum Space Temp....:	97.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	55.0 F
Minimum Space Temp....:	45.0 F	74.0 F
Outside Air Temp @ Min:	7.0 F	54.0 F

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****

GENERAL

Name......: 8,31,32. Lunch Rm Srvice
Floor Area......: 391.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? Y

LIGHTING

Overhead Fixture: Recessed
Lamp Wattage....: 488.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE

Occupancy.......: 4 People
Activity Level..: Sedentary Work
Sensible........: 280.0 BTU/hr
Latent..........: 270.0 BTU/hr

OTHER LOADS

Equipment.......: 3.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES

Lighting....: Lights
Task Lights.: Lights
People......: People
Equipment...: People
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION

Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR

Type........:Slab On Grade
Perimeter.............: 18.8 ft
Slab Floor Area.......: 391.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	169.2	2	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	391.0	1	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	187.2 sqft	0.0 sqft
U-value...............:	0.329 BTU/hr/sqft/F	0.010 BTU/hr/sqft/F
Maximum Space Temp....:	97.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	55.0 F
Minimum Space Temp....:	45.0 F	74.0 F
Outside Air Temp @ Min:	7.0 F	54.0 F

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GENERAL
- Name......: 9,28. Lunch & Coat Rooms
- Floor Area......: 2010.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 1762.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 15 People
- Activity Level..: Seated at Rest
- Sensible........: 230.0 BTU/hr
- Latent..........: 120.0 BTU/hr

OTHER LOADS
- Equipment.......: 3.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 97.4 ft
- Slab Floor Area.......: 2010.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	645.6	2	1	0	-	1	0	-	N
E	76.8	2	1	0	-	1	0	-	N
W	446.4	2	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	2010.0	1	1	0

No partition data for this space.

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GENERAL
- Name......: 10,11,12,25. Wmn Lockers
- Floor Area......: 1081.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 1810.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 25 People
- Activity Level..: Medium Work
- Sensible........: 295.0 BTU/hr
- Latent..........: 455.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 56.8 ft
- Slab Floor Area.......: 1081.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	250.0	4	1	0	-	1	0	-	N
E	318.0	4	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1081.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 13,14,15,26. Men Lockers
- Floor Area......: 1137.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 1640.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 30 People
- Activity Level..: Medium Work
- Sensible........: 295.0 BTU/hr
- Latent..........: 455.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: People
- Equipment...: People
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 33.4 ft
- Slab Floor Area.......: 1137.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	334.0	4	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	1137.0	1	1	0

No partition data for this space.

****

GENERAL
Name......: 16. Men's Toilet
Floor Area......: 80.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 90.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 2 People
Activity Level..: Seated at Rest
Sensible........: 230.0 BTU/hr
Latent..........: 120.0 BTU/hr

OTHER LOADS
Equipment.......: 0.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: Lights
Equipment...: Lights
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 0.0 ft
Slab Floor Area.......: 80.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

===

No external wall or window data for this space.

===

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	Qty
HOR	-	80.0	1	1	0

===

No partition data for this space.

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SPACE DESCRIPTION

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****

GENERAL
- Name......: 17. Women's Toilet
- Floor Area......: 76.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 90.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 2 People
- Activity Level..: Seated at Rest
- Sensible........: 230.0 BTU/hr
- Latent..........: 120.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 0.0 ft
- Slab Floor Area.......: 76.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

No external wall or window data for this space.

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	76.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
Name......: 18. Office
Floor Area......: 117.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 340.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 2 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 3.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: Lights
Equipment...: Lights
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 0.0 ft
Slab Floor Area.......: 117.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

==

No external wall or window data for this space.

==

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	117.0	1	1	0

==

No partition data for this space.

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SPACE DESCRIPTION

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****

GENERAL
- Name......: 19. Office
- Floor Area......: 133.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 340.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 2 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 3.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 12.2 ft
- Slab Floor Area.......: 133.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	109.8	2	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	133.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
Name......: 20. Ordinance Office
Floor Area......: 624.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 2580.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 6 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 3.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: Lights
Equipment...: Lights
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 56.8 ft
Slab Floor Area.......: 624.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	270.0	2	1	0	-	1	0	-	N
E	187.2	2	1	0	-	1	0	-	N
W	54.0	2	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	624.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
Name......: 21. Corridor
Floor Area......: 106.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 600.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 0 People
Activity Level..: Medium Work
Sensible........: 295.0 BTU/hr
Latent..........: 455.0 BTU/hr

OTHER LOADS
Equipment.......: 0.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: Lights
Equipment...: Lights
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 10.0 ft
Slab Floor Area.......: 106.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	100.0	2	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	106.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL

Name......: 22. Corridor

Floor Area......: 89.0 sqft

Building Weight.: 70.0 lb/sqft

Windows Shaded..? N

Partitions Used.? N

LIGHTING

Overhead Fixture: Recessed

Lamp Wattage....: 340.0 W

Ballast Mult....: 1.00

Task Lighting...: 0.00 W/sqft

PEOPLE

Occupancy.......: 0 People

Activity Level..: Medium Work

Sensible........: 295.0 BTU/hr

Latent..........: 455.0 BTU/hr

OTHER LOADS

Equipment.......: 0.00 W/sqft

Misc. Sensible..: 0.0 BTU/hr

Misc. Latent....: 0.0 BTU/hr

SCHEDULES

Lighting....: Lights

Task Lights.: Lights

People......: Lights

Equipment...: Lights

Misc. Sens..: Lights

Misc. Latent: Lights

INFILTRATION

Cooling.....: 0.00 CFM/sqft

Heating.....: 0.00 CFM/sqft

Typical.....: 0.00 CFM/sqft

When Fan On.? N

FLOOR

Type........:Slab On Grade

Perimeter.............: 0.0 ft

Slab Floor Area.......: 89.0 sqft

Floor R-Value.........: 0.50

Insulation R-value....: 7.00

===

No external wall or window data for this space.

===

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	89.0	1	1	0

===

No partition data for this space.

===

****

GENERAL		**SCHEDULES**	
Name......:	23. Corridor	Lighting....:	Lights
Floor Area......:	190.0 sqft	Task Lights.:	Lights
Building Weight.:	70.0 lb/sqft	People......:	Lights
Windows Shaded..?	N	Equipment...:	Lights
Partitions Used.?	N	Misc. Sens..:	Lights
LIGHTING		Misc. Latent:	Lights
Overhead Fixture:	Recessed	**INFILTRATION**	
Lamp Wattage....:	860.0 W	Cooling.....:	0.00 CFM/sqft
Ballast Mult....:	1.00	Heating.....:	0.00 CFM/sqft
Task Lighting...:	0.00 W/sqft	Typical.....:	0.00 CFM/sqft
PEOPLE		When Fan On.?	N
Occupancy.......:	0 People	**FLOOR**	
Activity Level..:	Medium Work	Type........:	Slab On Grade
Sensible........:	295.0 BTU/hr	Perimeter.............:	0.0 ft
Latent..........:	455.0 BTU/hr	Slab Floor Area.......:	190.0 sqft
OTHER LOADS		Floor R-Value.........:	0.50
Equipment.......:	0.00 W/sqft	Insulation R-value....:	7.00
Misc. Sensible..:	0.0 BTU/hr		
Misc. Latent....:	0.0 BTU/hr		

No external wall or window data for this space.

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	190.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 24,27. Corridor & Janitr
- Floor Area......: 349.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 230.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 9.9 ft
- Slab Floor Area.......: 349.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	79.2	2	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	349.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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GENERAL
- Name......: 30. Mechanical Room
- Floor Area......: 666.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 770.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 10.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 62.8 ft
- Slab Floor Area.......: 666.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	274.6	3	1	0	-	1	0	-	N
W	554.4	3	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	666.0	1	1	0

PARTITION LOADS	Type 1	Type 2
Type.................:	Partition	Ceiling
Area.................:	274.6 sqft	0.0 sqft
U-value..............:	0.495 BTU/hr/sqft/F	0.010 BTU/hr/sqft/F
Maximum Space Temp....:	75.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	55.0 F
Minimum Space Temp....:	60.0 F	74.0 F
Outside Air Temp @ Min:	7.0 F	54.0 F

SPACE DESCRIPTION

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****

GENERAL
- Name......: 33,34,35&36. Annex
- Floor Area......: 756.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 1020.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: Lights
- Equipment...: Lights
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type.........:Slab On Grade
- Perimeter.............: 132.0 ft
- Slab Floor Area.......: 756.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	336.0	3	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	864.0	1	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 117-3: 1. Mech Room
- Floor Area......: 2944.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 4820.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Office Work
- Sensible........: 245.0 BTU/hr
- Latent..........: 205.0 BTU/hr

OTHER LOADS
- Equipment.......: 7.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 82.2 ft
- Slab Floor Area.......: 2944.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	970.0	6	1	0	-	1	0	-	N
E	189.0	7	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
S	5	2944.0	2	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Partition
Area..................:	1212.0 sqft	661.0 sqft
U-value...............:	0.541 BTU/hr/sqft/F	0.212 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	45.0 F	68.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

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GENERAL
- Name......: 117-3: 2. Control Room
- Floor Area......: 710.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 2920.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 3 People
- Activity Level..: Sedentary Work
- Sensible........: 280.0 BTU/hr
- Latent..........: 270.0 BTU/hr

OTHER LOADS
- Equipment.......: 3.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 0.0 ft
- Slab Floor Area.......: 710.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

No external wall or window data for this space.

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
S	5	2944.0	4	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Partition
Area..................:	491.2 sqft	0.0 sqft
U-value...............:	0.212 BTU/hr/sqft/F	0.212 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	45.0 F	68.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

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GENERAL
- Name......: 117-3: 3. Wrk Corr BL&R1
- Floor Area......: 3860.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 11000.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 8 People
- Activity Level..: Medium Work
- Sensible........: 295.0 BTU/hr
- Latent..........: 455.0 BTU/hr

OTHER LOADS
- Equipment.......: 5.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 330.0 CFM
- When Fan On.? Y

FLOOR
- Type........:Slab On Grade
- Perimeter............: 50.0 ft
- Slab Floor Area.......: 3860.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	292.5	9	1	0	-	1	0	-	N
W	292.5	9	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	3860.0	3	1	0

PARTITION LOADS	Type 1	Type 2
Type.................:	Partition	Partition
Area.................:	606.1 sqft	0.0 sqft
U-value..............:	0.541 BTU/hr/sqft/F	0.212 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	45.0 F	68.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

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GENERAL		SCHEDULES	
Name......:	117-3: 3. Wrk Corr R2	Lighting....:	117-3 Schedule
Floor Area......:	3860.0 sqft	Task Lights.:	117-3 Schedule
Building Weight.:	70.0 lb/sqft	People......:	117-3 Schedule
Windows Shaded..?	N	Equipment...:	Continuous
Partitions Used.?	Y	Misc. Sens..:	Lights
LIGHTING		Misc. Latent:	Lights
Overhead Fixture:	Free-Hanging	INFILTRATION	
Lamp Wattage....:	11000.0 W	Cooling.....:	0.00 CFM/sqft
Ballast Mult....:	1.00	Heating.....:	0.00 CFM/sqft
Task Lighting...:	0.00 W/sqft	Typical.....:	82.5 CFM
PEOPLE		When Fan On.?	Y
Occupancy.......:	8 People	FLOOR	
Activity Level..:	Medium Work	Type........:	Slab On Grade
Sensible........:	295.0 BTU/hr	Perimeter.............:	50.0 ft
Latent..........:	455.0 BTU/hr	Slab Floor Area........:	3860.0 sqft
OTHER LOADS		Floor R-Value.........:	0.50
Equipment.......:	5.00 W/sqft	Insulation R-value....:	7.00
Misc. Sensible..:	0.0 BTU/hr		
Misc. Latent....:	0.0 BTU/hr		

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	292.5	9	1	0	-	1	0	-	N
W	292.5	9	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	3860.0	3	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Partition
Area..................:	606.1 sqft	0.0 sqft
U-value...............:	0.541 BTU/hr/sqft/F	0.212 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	45.0 F	68.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

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GENERAL
- Name......: 117-3: 4. Inrt Stg BL&R1
- Floor Area......: 1940.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 2750.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 2 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 3.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 330.0 CFM
- When Fan On.? Y

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 96.5 ft
- Slab Floor Area.......: 1940.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	827.8	6	1	0	-	1	0	-	N
E	428.1	6	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
S	5	1940.0	2	1	0

PARTITION LOADS	Type 1	Type 2
Type.................:	Partition	Partition
Area.................:	428.1 sqft	0.0 sqft
U-value..............:	0.595 BTU/hr/sqft/F	0.212 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	45.0 F	68.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

Prepared by: Keller & Gannon
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GENERAL
- Name......: 117-3: 4. Inrt Stg R2
- Floor Area......: 1940.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 2750.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 2 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 3.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 82.5 CFM
- When Fan On.? Y

FLOOR
- Type........:Slab On Grade
- Perimeter............: 96.5 ft
- Slab Floor Area.......: 1940.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	827.8	6	1	0	-	1	0	-	N
E	428.1	6	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
S	5	1940.0	2	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Partition
Area..................:	428.1 sqft	0.0 sqft
U-value...............:	0.595 BTU/hr/sqft/F	0.212 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	45.0 F	68.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

***

GENERAL
- Name......: 117-3: 5. Cell 1
- Floor Area......: 630.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 1500.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 1 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 5.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 23.0 ft
- Slab Floor Area.......: 630.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	299.0	10	1	0	-	1	0	-	N
W	408.7	9	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
N	5	630.0	2	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 117-3: 6. Cell 2
- Floor Area......: 630.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 1500.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 1 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 5.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 23.0 ft
- Slab Floor Area.......: 630.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	299.0	10	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
N	5	630.0	2	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 117-3: 7. Cell 3
- Floor Area......: 630.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 1500.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 1 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 5.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 23.0 ft
- Slab Floor Area.......: 630.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	299.0	10	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
N	5	630.0	2	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 117-3: 8. Cell 4
- Floor Area......: 630.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 1500.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 1 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 5.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 23.0 ft
- Slab Floor Area.......: 630.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	299.0	10	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
N	5	630.0	2	1	0

No partition data for this space.

SPACE DESCRIPTION

Prepared by: Keller & Gannon 12-20-94

GENERAL
- Name......: 117-3: 9. Cell 5
- Floor Area......: 242.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 500.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 1 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 3.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 16.8 ft
- Slab Floor Area.......: 242.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	217.8	10	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
N	5	242.0	2	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
Name......: 117-3: 10. Cell 6
Floor Area......: 240.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? N

LIGHTING
Overhead Fixture: Free-Hanging
Lamp Wattage....: 500.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 1 People
Activity Level..: Heavy Work
Sensible........: 525.0 BTU/hr
Latent..........: 925.0 BTU/hr

OTHER LOADS
Equipment.......: 3.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: 117-3 Schedule
Task Lights.: 117-3 Schedule
People......: 117-3 Schedule
Equipment...: Continuous
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 16.5 ft
Slab Floor Area.......: 240.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	214.5	10	1	0	-	1	0	-	N
E	195.8	3	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
N	5	240.0	2	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 117-3: 11. Breakdn Area
- Floor Area......: 500.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 1500.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 3 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 3.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type.........:Slab On Grade
- Perimeter.............: 14.8 ft
- Slab Floor Area.......: 500.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
E	216.8	3	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
N	5	500.0	2	1	0

No partition data for this space.

SPACE DESCRIPTION

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GENERAL
- Name......: 117-3: 12. Supervsr Offc
- Floor Area......: 412.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 1550.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 4 People
- Activity Level..: Sedentary Work
- Sensible........: 280.0 BTU/hr
- Latent..........: 270.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: 117-3 Schedule
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 40.8 ft
- Slab Floor Area.......: 412.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	178.4	2	1	0	-	1	0	-	N
W	148.0	2	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
S	5	412.0	4	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Partition
Area..................:	148.0 sqft	0.0 sqft
U-value...............:	0.212 BTU/hr/sqft/F	0.010 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	75.0 F
Outside Air Temp @ Max:	97.0 F	55.0 F
Minimum Space Temp....:	45.0 F	74.0 F
Outside Air Temp @ Min:	7.0 F	54.0 F

SPACE DESCRIPTION

Prepared by: Keller & Gannon 12-20-94

****

GENERAL
- Name......: 117-3: 13. Corridor&Jan
- Floor Area......: 139.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 440.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 0.0 ft
- Slab Floor Area.......: 139.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

No external wall or window data for this space.

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
S	5	139.0	4	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 117-3: 14. Men's Toilet
- Floor Area......: 200.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 340.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 2 People
- Activity Level..: Seated at Rest
- Sensible........: 230.0 BTU/hr
- Latent..........: 120.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 10.5 ft
- Slab Floor Area.......: 200.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	84.0	4	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
S	5	200.0	4	1	0

No partition data for this space.

SPACE DESCRIPTION

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****

GENERAL
- Name......: 117-3: 15 Women's Toilet
- Floor Area......: 250.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? N

LIGHTING
- Overhead Fixture: Recessed
- Lamp Wattage....: 510.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 3 People
- Activity Level..: Seated at Rest
- Sensible........: 230.0 BTU/hr
- Latent..........: 120.0 BTU/hr

OTHER LOADS
- Equipment.......: 1.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: 117-3 Schedule
- Task Lights.: 117-3 Schedule
- People......: 117-3 Schedule
- Equipment...: Continuous
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 16.0 ft
- Slab Floor Area.......: 250.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	128.0	4	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
S	5	250.0	4	1	0

No partition data for this space.

****

GENERAL
Name......: 117-5: 1. Work Rm BL&R1
Floor Area......: 3679.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? Y

LIGHTING
Overhead Fixture: Free-Hanging
Lamp Wattage....: 14430.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 10 People
Activity Level..: Heavy Work
Sensible........: 525.0 BTU/hr
Latent..........: 925.0 BTU/hr

OTHER LOADS
Equipment.......: 10.00 W/sqft
Misc. Sensible..: 5000.0 BTU/hr
Misc. Latent....: 67940.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: 117-5 Schedule
Equipment...: 117-5 Schedule
Misc. Sens..: 117-5 Schedule
Misc. Latent: 117-5 Schedule

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 2200.0 CFM
When Fan On.? Y

FLOOR
Type........:Slab On Grade
Perimeter............: 183.1 ft
Slab Floor Area........: 3679.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	2776.1	7	1	0	-	1	0	-	N
E	2869.1	7	1	0	-	1	0	-	N
W	2869.1	7	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	3679.0	6	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Partition
Area..................:	1928.3 sqft	847.7 sqft
U-value...............:	0.541 BTU/hr/sqft/F	0.541 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	80.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	55.0 F	55.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

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HAP v3.06

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****

GENERAL
- Name......: 117-5: 1. Work Rm R2&3
- Floor Area......: 3679.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 14430.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 10 People
- Activity Level..: Heavy Work
- Sensible........: 525.0 BTU/hr
- Latent..........: 925.0 BTU/hr

OTHER LOADS
- Equipment.......: 10.00 W/sqft
- Misc. Sensible..: 5000.0 BTU/hr
- Misc. Latent....: 67940.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: 117-5 Schedule
- Equipment...: 117-5 Schedule
- Misc. Sens..: 117-5 Schedule
- Misc. Latent: 117-5 Schedule

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 500.0 CFM
- When Fan On.? Y

FLOOR
- Type........:Slab On Grade
- Perimeter.............: 183.1 ft
- Slab Floor Area.......: 3679.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
N	2776.1	7	1	0	-	1	0	-	N
E	2869.1	7	1	0	-	1	0	-	N
W	2869.1	7	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	3679.0	6	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Partition
Area..................:	1928.3 sqft	847.7 sqft
U-value...............:	0.541 BTU/hr/sqft/F	0.541 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	80.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	55.0 F	55.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

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GENERAL
- Name......: 117-5: 3. Mechanical Rm
- Floor Area......: 2049.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 3440.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 2 People
- Activity Level..: Medium Work
- Sensible........: 295.0 BTU/hr
- Latent..........: 455.0 BTU/hr

OTHER LOADS
- Equipment.......: 7.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: 117-5 Schedule
- Equipment...: 117-5 Schedule
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 50.0 CFM
- When Fan On.? Y

FLOOR
- Type........:Slab On Grade
- Perimeter............: 161.7 ft
- Slab Floor Area.......: 2049.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	592.1	7	1	0	-	1	0	-	N
E	852.0	7	1	0	-	1	0	-	N
W	852.0	7	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	2368.0	6	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	847.7 sqft	238.8 sqft
U-value...............:	0.541 BTU/hr/sqft/F	5.000 BTU/hr/sqft/F
Maximum Space Temp....:	80.0 F	85.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	58.0 F	55.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

****

GENERAL
Name......: 117-5: 4. Corridor
Floor Area......: 92.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? Y

LIGHTING
Overhead Fixture: Recessed
Lamp Wattage....: 90.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 0 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 0.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: 117-5 Schedule
Equipment...: 117-5 Schedule
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 4.3 ft
Slab Floor Area.......: 92.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
W	34.0	7	1	0	-	1	0	-	N

No roof or door data for this space.

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	172.8 sqft	92.0 sqft
U-value...............:	0.212 BTU/hr/sqft/F	0.075 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	85.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	55.0 F	55.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

Prepared by: Keller & Gannon 12-20-94

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GENERAL
Name......: 117-5: 5. Janitor Room
Floor Area......: 34.0 sqft
Building Weight.: 70.0 lb/sqft
Windows Shaded..? N
Partitions Used.? Y

LIGHTING
Overhead Fixture: Free-Hanging
Lamp Wattage....: 100.0 W
Ballast Mult....: 1.00
Task Lighting...: 0.00 W/sqft

PEOPLE
Occupancy.......: 0 People
Activity Level..: Office Work
Sensible........: 245.0 BTU/hr
Latent..........: 205.0 BTU/hr

OTHER LOADS
Equipment.......: 0.00 W/sqft
Misc. Sensible..: 0.0 BTU/hr
Misc. Latent....: 0.0 BTU/hr

SCHEDULES
Lighting....: Lights
Task Lights.: Lights
People......: 117-5 Schedule
Equipment...: 117-5 Schedule
Misc. Sens..: Lights
Misc. Latent: Lights

INFILTRATION
Cooling.....: 0.00 CFM/sqft
Heating.....: 0.00 CFM/sqft
Typical.....: 0.00 CFM/sqft
When Fan On.? N

FLOOR
Type........:Slab On Grade
Perimeter.............: 0.0 ft
Slab Floor Area.......: 34.0 sqft
Floor R-Value.........: 0.50
Insulation R-value....: 7.00

No external wall or window data for this space.

No roof or door data for this space.

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	0.0 sqft	34.0 sqft
U-value...............:	0.212 BTU/hr/sqft/F	0.075 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	85.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	55.0 F	55.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

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GENERAL

- Name......: 117-5: 6. Men's Toilet
- Floor Area......: 154.0 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING

- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 260.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE

- Occupancy.......: 2 People
- Activity Level..: Seated at Rest
- Sensible........: 230.0 BTU/hr
- Latent..........: 120.0 BTU/hr

OTHER LOADS

- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES

- Lighting....: Lights
- Task Lights.: Lights
- People......: 117-5 Schedule
- Equipment...: 117-5 Schedule
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION

- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR

- Type........:Slab On Grade
- Perimeter.............: 12.0 ft
- Slab Floor Area.......: 154.0 sqft
- Floor R-Value.........: 0.50
- Insulation R-value....: 7.00

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	96.0	4	1	0	-	1	0	-	N

No roof or door data for this space.

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	184.0 sqft	154.0 sqft
U-value...............:	0.212 BTU/hr/sqft/F	0.075 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	85.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	55.0 F	55.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

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GENERAL		SCHEDULES	
Name......: 117-5:	7. Women's WC	Lighting....:	Lights
Floor Area......:	192.0 sqft	Task Lights.:	Lights
Building Weight.:	70.0 lb/sqft	People......:	117-5 Schedule
Windows Shaded..?	N	Equipment...:	117-5 Schedule
Partitions Used.?	Y	Misc. Sens..:	Lights
LIGHTING		Misc. Latent:	Lights
Overhead Fixture:	Free-Hanging	INFILTRATION	
Lamp Wattage....:	260.0 W	Cooling.....:	0.00 CFM/sqft
Ballast Mult....:	1.00	Heating.....:	0.00 CFM/sqft
Task Lighting...:	0.00 W/sqft	Typical.....:	0.00 CFM/sqft
PEOPLE		When Fan On.?	N
Occupancy.......:	2 People	FLOOR	
Activity Level..:	Seated at Rest	Type.........:	Slab On Grade
Sensible........:	230.0 BTU/hr	Perimeter.............:	27.7 ft
Latent..........:	120.0 BTU/hr	Slab Floor Area.......:	192.0 sqft
OTHER LOADS		Floor R-Value.........:	0.50
Equipment.......:	0.00 W/sqft	Insulation R-value....:	7.00
Misc. Sensible..:	0.0 BTU/hr		
Misc. Latent....:	0.0 BTU/hr		

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	108.8	4	1	0	-	1	0	-	N
E	112.8	4	1	0	-	1	0	-	N

No roof or door data for this space.

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	0.0 sqft	192.0 sqft
U-value...............:	0.212 BTU/hr/sqft/F	0.075 BTU/hr/sqft/F
Maximum Space Temp....:	85.0 F	85.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	55.0 F	55.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

SPACE DESCRIPTION

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GENERAL
- Name......: 117-5: Wk/Mch Rm Plenum
- Floor Area......: 238.8 sqft
- Building Weight.: 70.0 lb/sqft
- Windows Shaded..? N
- Partitions Used.? Y

LIGHTING
- Overhead Fixture: Free-Hanging
- Lamp Wattage....: 400.0 W
- Ballast Mult....: 1.00
- Task Lighting...: 0.00 W/sqft

PEOPLE
- Occupancy.......: 0 People
- Activity Level..: Seated at Rest
- Sensible........: 230.0 BTU/hr
- Latent..........: 120.0 BTU/hr

OTHER LOADS
- Equipment.......: 0.00 W/sqft
- Misc. Sensible..: 0.0 BTU/hr
- Misc. Latent....: 0.0 BTU/hr

SCHEDULES
- Lighting....: Lights
- Task Lights.: Lights
- People......: 117-5 Schedule
- Equipment...: 117-5 Schedule
- Misc. Sens..: Lights
- Misc. Latent: Lights

INFILTRATION
- Cooling.....: 0.00 CFM/sqft
- Heating.....: 0.00 CFM/sqft
- Typical.....: 0.00 CFM/sqft
- When Fan On.? N

FLOOR
- Type........:Above Conditioned Space

WALL Exp	Gross Area (sqft)	WALL Type	WINDOW Type	WINDOW Qty	WINDOW Shade	WINDOW Type	WINDOW Qty	WINDOW Shade	Any Doors?
S	1928.3	10	1	0	-	1	0	-	N
E	129.2	7	1	0	-	1	0	-	N
W	129.2	7	1	0	-	1	0	-	N

ROOF Exp	Slope (deg)	Gross Area (sqft)	ROOF Type	SKYLIGHT Type	SKYLIGHT Qty
HOR	-	238.8	6	1	0

PARTITION LOADS	Type 1	Type 2
Type..................:	Partition	Ceiling
Area..................:	3122.3 sqft	0.0 sqft
U-value...............:	0.541 BTU/hr/sqft/F	0.075 BTU/hr/sqft/F
Maximum Space Temp....:	80.0 F	85.0 F
Outside Air Temp @ Max:	97.0 F	97.0 F
Minimum Space Temp....:	58.0 F	55.0 F
Outside Air Temp @ Min:	7.0 F	7.0 F

AIR SYSTEM INPUT DATA

Name: UH-701. 2 Htrs,117-1 Mech Rm BL
Type: TERMINAL UNITS - 2-Pipe Fan Coils
Prepared by: Keller & Gannon

11-03-94
HAP v3.06

****

1. SYSTEM NAME AND TYPE

Name............: UH-701. 2 Htrs,117-1 Mech Rm BL
Type............: TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.: 1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Supply Air....................:	315.0 CFM
Fan Cycled for Cooling........?	N
Coil Bypass Factor............:	0.100
HEATING SYSTEM DATA	
Fan Cycled for Heating........?	Y
Supply Air Temperature........?	110.0 F
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	0.0 CFM

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	90.0	
Unoccupied Cooling..(F):	120.0	
Occupied Heating....(F):	55.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Terminal Type...........:	Fan Coil	
Fan kW.....................:	0.2	
Fan Efficiency...........(%):	-	

****

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Terminal Cooling.......												

AIR SYSTEM INPUT DATA

Name: UH-701. 2 Htrs,117-1 Mech Rm R1 — 11-03-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils — HAP v3.06
Prepared by: Keller & Gannon — Page 1

****

1. SYSTEM NAME AND TYPE

Name............:	UH-701. 2 Htrs,117-1 Mech Rm R1
Type............:	TERMINAL UNITS - 2-Pipe Fan Coils
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Supply Air....................:	315.0 CFM
Fan Cycled for Cooling........?	N
Coil Bypass Factor............:	0.100
HEATING SYSTEM DATA	
Fan Cycled for Heating........?	Y
Supply Air Temperature........?	110.0 F
OUTDOOR VENTILATION DATA	
Common Ventilation System Used?	N
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	0.0 CFM

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	90.0	
Unoccupied Cooling..(F):	120.0	
Occupied Heating....(F):	45.0	
Unoccupied Heating..(F):	45.0	
Throttling Range....(F):	3.0	
Zone Terminal Type............:	Fan Coil	
Fan kW......................:	0.2	
Fan Efficiency...........(%):	-	

AIR SYSTEM INPUT DATA

Name: UH-701. 2 Htrs,117-1 Mech Rm R1 11-03-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils HAP v3.06
Prepared by: Keller & Gannon Page 2

****

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Terminal Heating.......	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Terminal Cooling.......												

AIR SYSTEM INPUT DATA

Name: UH-701. 2 Htrs,117-1 Mech Rm BL   11-03-94
Type: TERMINAL UNITS - 2-Pipe Fan Coils   HAP v3.06
Prepared by: Keller & Gannon   Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
21. 30. Mechanical Room	1		

AIR SYSTEM INPUT DATA

Name: Anex Fan&Elec Htg Coil, 117-1 BL
Type: CONSTANT VOLUME - Tempering System
Prepared by: Keller & Gannon

****

1. SYSTEM NAME AND TYPE

Name............:	Anex Fan&Elec Htg Coil, 117-1 BL
Type............:	CONSTANT VOLUME - Tempering System
Number of Zones.:	1

2. SYSTEM DESCRIPTION

OUTDOOR VENTILATION DATA	
Design Ventilation Airflow....:	600.0 CFM
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Blow-Thru
Fan kW........................:	0.2 kW
HEATING COIL	
Use Heating Coil..............?	Y
Setpoint......................:	45.0 F
COOLING COIL	
Use Cooling Coil..............?	N

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weekday...............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Saturday..............	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sunday................	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

AIR SYSTEM INPUT DATA

Name: Annex Fan and Electric Htg Coil 10-31-94
Type: CONSTANT VOLUME - Simple CAV HAP v3.06
Prepared by: Keller & Gannon Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
22. 33,34,35&36. Annex	1		

AIR SYSTEM INPUT DATA

Name: AC-701 ACTUAL Conditns,117-1 BL — 11-03-94
Type: CONSTANT VOLUME - Dual Duct CAV — HAP v3.06
Prepared by: Keller & Gannon — Page 1

****

1. SYSTEM NAME AND TYPE

Name............: AC-701 ACTUAL Conditns,117-1 BL
Type............: CONSTANT VOLUME - Dual Duct CAV
Number of Zones.: 6

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Cold Deck Temperature.........: 55.0 F
Coil Bypass Factor............: 0.100
Cold Deck Reset...............: Not Used
HEATING SYSTEM DATA
Hot Deck Temperature..........: 105.0 F
Hot Deck Reset................: Not Used
OUTDOOR VENTILATION DATA
Type of Control...............: Constant Airflow Rate
Design Ventilation Airflow....: 0.0 CFM
Dampers Open During Unocc Per.: N
Damper Leak Rate..............: 0 %
SUPPLY DUCT DATA
Duct Heat Gain................: 2 %
Duct Leakage Rate.............: 2 %
RETURN PLENUM DATA
Is a Return Plenum Used.......? N
SUPPLY FAN DATA
Fan Type......................: Forward Curved
Fan kW........................: 7.5 kW
RETURN FAN DATA
Fan Type......................: Forward Curved
Fan kW........................: 0.7 kW
OUTDOOR AIR ECONOMIZER
Outdoor Economizer Type.......: None
PREHEAT COIL
Preheat Coil Used.............? N
PRECOOL COIL
Precool Coil Used.............? N
VENTILATION HEAT RECLAIM
Reclaim Unit Type.............: None
SAFETY FACTORS
Sensible Cooling Factor.......: 5 %
Latent Cooling Factor.........: 5 %
Heating Factor................: 5 %

==

3. ZONE DATA

ZONE	1	2	3	4
T-Stat Occupied Cooling....(F):	75.0	75.0	75.0	75.0
Unoccupied Cooling..(F):	85.0	85.0	85.0	85.0
Occupied Heating....(F):	70.0	70.0	70.0	70.0
Unoccupied Heating..(F):	60.0	60.0	60.0	60.0
Throttling Range....(F):	3.0	3.0	3.0	3.0
Zone Heating Unit Type........:	None	None	None	None
Trip Temperature.........(F):	-	-	-	-
Design Supply Temperature(F):	-	-	-	-
Fan Total Static....(in.wg.):	-	-	-	-
Fan Efficiency..........(%):	-	-	-	-
Zone Terminal Type............:	CAV MBox	CAV MBox	CAV MBox	CAV MBox
Reheat Coil.................?	N	N	N	N
Diversity Factor...........(%):	100	100	100	100
Direct Exhaust Airflow...(CFM):	470.0	1880.0	200.0	1450.0
Direct Exhaust Fan kW.....(kW):	0.3	1.4	0.0	0.2

ZONE	5	6
T-Stat Occupied Cooling....(F):	75.0	75.0
Unoccupied Cooling..(F):	85.0	85.0
Occupied Heating....(F):	70.0	70.0
Unoccupied Heating..(F):	60.0	60.0
Throttling Range....(F):	3.0	3.0
Zone Heating Unit Type........:	None	None
Trip Temperature.........(F):	-	-
Design Supply Temperature(F):	-	-
Fan Total Static....(in.wg.):	-	-
Fan Efficiency..........(%):	-	-
Zone Terminal Type............:	CAV MBox	CAV MBox
Reheat Coil.................?	N	N
Diversity Factor...........(%):	100	100
Direct Exhaust Airflow...(CFM):	1450.0	0.0
Direct Exhaust Fan kW.....(kW):	0.2	0.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? Y

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

****

1. SYSTEM NAME AND TYPE

Name............: AC-701 ACTUAL Conditns,117-1 R1
Type............: CONSTANT VOLUME - Dual Duct CAV
Number of Zones.: 6

===

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Cold Deck Temperature.........:	55.0 F
Coil Bypass Factor............:	0.100
Cold Deck Reset...............:	Greatest Demand
Maximum Reset Temperature.....:	65.0 F
HEATING SYSTEM DATA	
Hot Deck Temperature..........:	105.0 F
Hot Deck Reset................:	Greatest Demand
Minimum Reset Temperature.....:	90.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	5125.0 CFM
Dampers Open During Unocc Per.:	N
Damper Leak Rate..............:	0 %
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	2 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Fan kW........................:	7.5 kW
RETURN FAN DATA	
Fan Type......................:	Forward Curved
Fan kW........................:	0.7 kW
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	Integrated Dry-Bulb
OA Upper Cutoff Temp..........:	150.0 F
OA Lower Cutoff Temp..........:	-60.0 F
PREHEAT COIL	
Preheat Coil Used............?	N
PRECOOL COIL	
Precool Coil Used............?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

===

3. ZONE DATA

ZONE	1	2	3	4
T-Stat Occupied Cooling....(F):	78.0	78.0	78.0	78.0
Unoccupied Cooling..(F):	85.0	85.0	85.0	85.0
Occupied Heating....(F):	68.0	68.0	68.0	68.0
Unoccupied Heating..(F):	55.0	55.0	55.0	55.0
Throttling Range....(F):	3.0	3.0	3.0	3.0
Zone Heating Unit Type........:	None	None	None	None
Trip Temperature.........(F):	-	-	-	-
Design Supply Temperature(F):	-	-	-	-
Fan Total Static....(in.wg.):	-	-	-	-
Fan Efficiency...........(%):	-	-	-	-
Zone Terminal Type............:	CAV MBox	CAV MBox	CAV MBox	CAV MBox
Reheat Coil.................?	N	N	N	N
Diversity Factor...........(%):	100	100	100	100
Direct Exhaust Airflow...(CFM):	470.0	1880.0	200.0	1450.0
Direct Exhaust Fan kW.....(kW):	0.3	1.4	0.0	0.2

ZONE	5	6
T-Stat Occupied Cooling....(F):	78.0	78.0
Unoccupied Cooling..(F):	85.0	85.0
Occupied Heating....(F):	68.0	68.0
Unoccupied Heating..(F):	55.0	55.0
Throttling Range....(F):	3.0	3.0
Zone Heating Unit Type........:	None	None
Trip Temperature.........(F):	-	-
Design Supply Temperature(F):	-	-
Fan Total Static....(in.wg.):	-	-
Fan Efficiency...........(%):	-	-
Zone Terminal Type............:	CAV MBox	CAV MBox
Reheat Coil.................?	N	N
Diversity Factor...........(%):	100	100
Direct Exhaust Airflow...(CFM):	1450.0	0.0
Direct Exhaust Fan kW.....(kW):	0.2	0.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? Y

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-701 ACTUAL Conditns,117-1 BL — 11-03-94

Type: CONSTANT VOLUME - Dual Duct CAV — HAP v3.06

Prepared by: Keller & Gannon — Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
1. 1. Wet Lab Office & Hall	1	2. 2. Test Cell & Fume Hood	1
3. 3. Test Cell w/o Hood	1		
SPACES IN ZONE 2 (Zone 2)			
4. 4. Instrument Lab	1	5. 5. Biochemical Lab	1
6. 6. Wet Chemistry Lab	1	7. 7. Balance & Oven Room	1
SPACES IN ZONE 3 (Zone 3)			
8. 8,31,32. Lunch Rm Srvice	1	9. 9,28. Lunch & Coat Rooms	1
SPACES IN ZONE 4 (Zone 4)			
10. 10,11,12,25. Wmn Lockers	1	11. 24,27. Corridor & Janitr	1
SPACES IN ZONE 5 (Zone 5)			
12. 13,14,15,26. Men Lockers	1	13. 23. Corridor	1
SPACES IN ZONE 6 (Zone 6)			
15. 21. Corridor	1	16. 16. Men's Toilet	1
17. 17. Women's Toilet	1	18. 18. Office	1
19. 19. Office	1	20. 20. Ordinance Office	1

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AIR SYSTEM INPUT DATA

****

1. SYSTEM NAME AND TYPE

Name............:	AC-601, Control Room, 117-3 BL
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	2400.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	900.0 CFM
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	2 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	1.5 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	Integrated Dry-Bulb
OA Upper Cutoff Temp..........:	150.0 F
OA Lower Cutoff Temp..........:	-60.0 F
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: AC-601, Control Room, 117-3 BL — 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06
Prepared by: Keller & Gannon — Page 2

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	95.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	70.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type.........:	Space BB	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	1600.0	
Direct Exhaust Fan kW.....(kW):	0.1	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-601, Control Room, 117-3 BL 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
24. 117-3: 2. Control Room	1	34. 117-3: 12. Supervsr Offc	1
35. 117-3: 13. Corridor&Jan	1	36. 117-3: 14. Men's Toilet	1
37. 117-3: 15 Women's Toilet	1		

AIR SYSTEM INPUT DATA

****

1. SYSTEM NAME AND TYPE

Name............:	AC-601, Control Room, 117-3 R1
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	2400.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Greatest Demand
Maximum Reset Temperature.....:	65.0 F
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Greatest Demand
Minimum Reset Temperature.....:	80.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	900.0 CFM
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	2 %
Duct Leakage Rate.............:	2 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	1.5 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	Integrated Dry-Bulb
OA Upper Cutoff Temp..........:	150.0 F
OA Lower Cutoff Temp..........:	-60.0 F
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: AC-601, Control Room, 117-3 R1 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon Page 2

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	78.0	
Unoccupied Cooling..(F):	95.0	
Occupied Heating....(F):	68.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	Space BB	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type...........:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	1600.0	
Direct Exhaust Fan kW.....(kW):	0.1	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-601, Control Room, 117-3 R1 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
24. 117-3: 2. Control Room	1	34. 117-3: 12. Supervsr Offc	1
35. 117-3: 13. Corridor&Jan	1	36. 117-3: 14. Men's Toilet	1
37. 117-3: 15 Women's Toilet	1		

AIR SYSTEM INPUT DATA

Name: AC-602, Work Corridor, 117-3 BL 11-23-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon

1. SYSTEM NAME AND TYPE

Name............:	AC-602, Work Corridor, 117-3 BL
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	5700.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	3.7 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0	
Unoccupied Cooling..(F):	95.0	
Occupied Heating....(F):	70.0	
Unoccupied Heating..(F):	60.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	Space BB	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-602, Work Corridor, 117-3 R1 11-23-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon Page 1

****

1. SYSTEM NAME AND TYPE

Name............: AC-602, Work Corridor, 117-3 R1
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

===

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA
Is Central Cooling Used.......? Y
Supply Air....................: 5700.0 CFM
Coil Bypass Factor............: 0.100
Fan Cycled for Cooling........? N
Supply Air Reset..............: Greatest Demand
Maximum Reset Temperature.....: 65.0 F
HEATING SYSTEM DATA
Is Central Heating Used.......? Y
Fan Cycled for Heating........? N
Supply Air Reset..............: Greatest Demand
Minimum Reset Temperature.....: 80.0 F
OUTDOOR VENTILATION DATA
Type of Control...............: Constant Airflow Rate
Design Ventilation Airflow....: 100 %
Dampers Open During Unocc Per.: Y
SUPPLY DUCT DATA
Duct Heat Gain................: 0 %
Duct Leakage Rate.............: 0 %
RETURN PLENUM DATA
Is a Return Plenum Used.......? N
SUPPLY FAN DATA
Fan Type......................: Forward Curved
Configuration.................: Draw-Thru
Fan kW........................: 3.7 kW
RETURN FAN DATA
Fan Type......................: None
OUTDOOR AIR ECONOMIZER
Outdoor Economizer Type.......: None
PREHEAT COIL
Preheat Coil Used.............? N
PRECOOL COIL
Precool Coil Used.............? N
HUMIDIFICATION
Humidification System Used....? N
DEHUMIDIFICATION
Dehumidification System Used..? N
VENTILATION HEAT RECLAIM
Reclaim Unit Type.............: None
SAFETY FACTORS
Sensible Cooling Factor.......: 0 %
Latent Cooling Factor.........: 0 %
Heating Factor................: 0 %

===

AIR SYSTEM INPUT DATA

Name: AC-602, Work Corridor, 117-3 R1 — 11-23-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06
Prepared by: Keller & Gannon —

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	78.0	
Unoccupied Cooling..(F):	95.0	
Occupied Heating....(F):	68.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	Space BB	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-602, Work Corridor, 117-3 R1 11-23-94

Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06

Prepared by: Keller & Gannon Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
25. 117-3: 3. Wrk Corr BL&R1	1	26. 117-3: 4. Inrt Stg BL&R1	1
27. 117-3: 5. Cell 1	1	28. 117-3: 6. Cell 2	1
29. 117-3: 7. Cell 3	1	30. 117-3: 8. Cell 4	1
31. 117-3: 9. Cell 5	1	32. 117-3: 10. Cell 6	1
33. 117-3: 11. Breakdn Area	1		

****

1. SYSTEM NAME AND TYPE

Name............:	AC-602, Work Corridor, 117-3 R2
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	5700.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Greatest Demand
Maximum Reset Temperature.....:	65.0 F
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Greatest Demand
Minimum Reset Temperature.....:	80.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	5.7 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: AC-602, Work Corridor, 117-3 R2 11-23-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon
****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	78.0	
Unoccupied Cooling..(F):	95.0	
Occupied Heating....(F):	68.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	Space BB	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-602, Work Corridor, 117-3 R2B — 11-23-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06
Prepared by: Keller & Gannon — Page 1

****

1. SYSTEM NAME AND TYPE

Name............: AC-602, Work Corridor, 117-3 R2B
Type............: CONSTANT VOLUME - Single Zone CAV
Number of Zones.: 1

==

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	5700.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Greatest Demand
Maximum Reset Temperature.....:	65.0 F
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Greatest Demand
Minimum Reset Temperature.....:	80.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	3.7 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	Sensible Only
Thermal Efficiency............:	70 %
Device Power Usage............:	0.1 kW
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

==

AIR SYSTEM INPUT DATA

Name: AC-602, Work Corridor, 117-3 R2B 11-23-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon Page 2

****

3. ZONE DATA

ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling....(F):	78.0
Unoccupied Cooling..(F):	95.0
Occupied Heating....(F):	68.0
Unoccupied Heating..(F):	55.0
Throttling Range....(F):	3.0
Zone Heating Unit Type.........:	Space BB
Trip Temperature.........(F):	-
Design Supply Temperature(F):	-
Fan Total Static....(in.wg.):	-
Fan Efficiency...........(%):	-
Zone Terminal Type............:	Diffuser
Reheat Coil.................?	N
Direct Exhaust Airflow...(CFM):	0.0
Direct Exhaust Fan kW.....(kW):	0.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		
Vent Reclaim Unit......	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
25. 117-3: 3. Wrk Corr BL&R1	1	26. 117-3: 4. Inrt Stg BL&R1	1
27. 117-3: 5. Cell 1	1	28. 117-3: 6. Cell 2	1
29. 117-3: 7. Cell 3	1	30. 117-3: 8. Cell 4	1
31. 117-3: 9. Cell 5	1	32. 117-3: 10. Cell 6	1
33. 117-3: 11. Breakdn Area	1		

AIR SYSTEM INPUT DATA

Name: HV-601 Mech Rm H&V Unit 117-3 BL 11-08-94

Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06

Prepared by: Keller & Gannon

****

1. SYSTEM NAME AND TYPE

Name............:	HV-601 Mech Rm H&V Unit 117-3 BL
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	N
HEATING SYSTEM DATA	
Supply Air Temperature........?	110.0 F
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	4000.0 CFM
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	3.0 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: HV-601 Mech Rm H&V Unit 117-3 BL — 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06
Prepared by: Keller & Gannon —

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	90.0	
Unoccupied Cooling..(F):	120.0	
Occupied Heating....(F):	60.0	
Unoccupied Heating..(F):	60.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	Space FC	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	110.0	
Fan kW.....................:	0.2	
Fan Efficiency...........(%):	-	
Zone Terminal Type...........:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
23. 117-3: 1. Mech Room	1		

AIR SYSTEM INPUT DATA

Name: HV-601 Mech Rm H&V Unit 117-3 R1 | 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV | HAP v3.06
Prepared by: Keller & Gannon | Page 1

****

1. SYSTEM NAME AND TYPE

Name............:	HV-601 Mech Rm H&V Unit 117-3 R1
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	N
HEATING SYSTEM DATA	
Supply Air Temperature........?	110.0 F
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Greatest Demand
Minimum Reset Temperature.....:	80.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	4000.0 CFM
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	3.0 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: HV-601 Mech Rm H&V Unit 117-3 R1 — 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06
Prepared by: Keller & Gannon — Page 2

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	90.0	
Unoccupied Cooling..(F):	120.0	
Occupied Heating....(F):	55.0	
Unoccupied Heating..(F):	45.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	Space FC	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	110.0	
Fan kW.....................:	0.2	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX

AIR SYSTEM INPUT DATA

Name: HV-601 Mech Rm H&V Unit 117-3 R1 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon Page 1

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1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
23. 117-3: 1. Mech Room	1		

AIR SYSTEM INPUT DATA

1. SYSTEM NAME AND TYPE

Name............:	AC-1001 Work Room 117-5 BASELINE
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	9500.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Not Used
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	5.6 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

****

3. ZONE DATA

ZONE	1 (All Zones the Same)
T-Stat Occupied Cooling....(F):	75.0
Unoccupied Cooling..(F):	75.0
Occupied Heating....(F):	75.0
Unoccupied Heating..(F):	75.0
Throttling Range....(F):	3.0
Zone Heating Unit Type........:	None
Trip Temperature.........(F):	-
Design Supply Temperature(F):	-
Fan Total Static....(in.wg.):	-
Fan Efficiency...........(%):	-
Zone Terminal Type............:	Diffuser
Reheat Coil.................?	N
Direct Exhaust Airflow...(CFM):	0.0
Direct Exhaust Fan kW.....(kW):	0.0

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 BASELINE 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon Page 1
****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
38. 117-5: 1. Work Rm BL&R1	1		

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R1 — 11-08-94

Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06

Prepared by: Keller & Gannon —

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1. SYSTEM NAME AND TYPE

Name............:	AC-1001 Work Room 117-5 R1
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	9500.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Greatest Demand
Maximum Reset Temperature.....:	65.0 F
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Greatest Demand
Minimum Reset Temperature.....:	90.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	5.6 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R1 — 11-08-94

Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06

Prepared by: Keller & Gannon —

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	78.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	68.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type...........:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R1 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
38. 117-5: 1. Work Rm BL&R1	1		

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R2 — 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06
Prepared by: Keller & Gannon — Page 1

****

1. SYSTEM NAME AND TYPE

Name............:	AC-1001 Work Room 117-5 R2
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	9500.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Greatest Demand
Maximum Reset Temperature.....:	65.0 F
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Greatest Demand
Minimum Reset Temperature.....:	80.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	7.1 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R2 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	78.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	68.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R2 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV HAP v3.06
Prepared by: Keller & Gannon

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
45. 117-5: 1. Work Rm R2&3	1		

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R3 — 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06
Prepared by: Keller & Gannon — Page 1

****

1. SYSTEM NAME AND TYPE

Name............:	AC-1001 Work Room 117-5 R3
Type............:	CONSTANT VOLUME - Single Zone CAV
Number of Zones.:	1

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Is Central Cooling Used.......?	Y
Supply Air....................:	9500.0 CFM
Coil Bypass Factor............:	0.100
Fan Cycled for Cooling........?	N
Supply Air Reset..............:	Greatest Demand
Maximum Reset Temperature.....:	65.0 F
HEATING SYSTEM DATA	
Is Central Heating Used.......?	Y
Fan Cycled for Heating........?	N
Supply Air Reset..............:	Greatest Demand
Minimum Reset Temperature.....:	80.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Configuration.................:	Draw-Thru
Fan kW........................:	7.1 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
HUMIDIFICATION	
Humidification System Used....?	N
DEHUMIDIFICATION	
Dehumidification System Used..?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	Sensible Only
Thermal Efficiency............:	70 %
Device Power Usage............:	0.2 kW
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R3 — 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV — HAP v3.06
Prepared by: Keller & Gannon — Page 2

****

3. ZONE DATA

ZONE	1	(All Zones the Same)
T-Stat Occupied Cooling....(F):	78.0	
Unoccupied Cooling..(F):	85.0	
Occupied Heating....(F):	68.0	
Unoccupied Heating..(F):	55.0	
Throttling Range....(F):	3.0	
Zone Heating Unit Type........:	None	
Trip Temperature.........(F):	-	
Design Supply Temperature(F):	-	
Fan Total Static....(in.wg.):	-	
Fan Efficiency...........(%):	-	
Zone Terminal Type............:	Diffuser	
Reheat Coil.................?	N	
Direct Exhaust Airflow...(CFM):	0.0	
Direct Exhaust Fan kW.....(kW):	0.0	

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? N

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Central Heating........	XXX	XXX	XXX	XXX	XXX					XXX	XXX	XXX
Central Cooling........					XXX	XXX	XXX	XXX	XXX	XXX		
Vent Reclaim Unit......	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

AIR SYSTEM INPUT DATA

Name: AC-1001 Work Room 117-5 R3 | 11-08-94
Type: CONSTANT VOLUME - Single Zone CAV | HAP v3.06
Prepared by: Keller & Gannon |

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
45. 117-5: 1. Work Rm R2&3	1		

AIR SYSTEM INPUT DATA

Name: AC-1002 Mech Rm & WCs 117-5 BL — 11-08-94
Type: CONSTANT VOLUME - Multizone — HAP v3.06
Prepared by: Keller & Gannon —

****

1. SYSTEM NAME AND TYPE

Name............:	AC-1002 Mech Rm & WCs 117-5 BL
Type............:	CONSTANT VOLUME - Multizone
Number of Zones.:	2

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Cold Deck Temperature.........:	85.0 F
Coil Bypass Factor............:	0.100
Cold Deck Reset...............:	Not Used
HEATING SYSTEM DATA	
Hot Deck Temperature..........:	70.0 F
Hot Deck Reset................:	Not Used
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Fan kW........................:	3.7 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

AIR SYSTEM INPUT DATA

Name: AC-1002 Mech Rm & WCs 117-5 BL — 11-08-94
Type: CONSTANT VOLUME - Multizone — HAP v3.06
Prepared by: Keller & Gannon — Page 2

3. ZONE DATA

ZONE	1	2
T-Stat Occupied Cooling....(F):	90.0	90.0
Unoccupied Cooling..(F):	120.0	120.0
Occupied Heating....(F):	55.0	69.0
Unoccupied Heating..(F):	55.0	69.0
Throttling Range....(F):	3.0	3.0
Zone Heating Unit Type........:	None	Space FC
Trip Temperature.........(F):	-	-
Design Supply Temperature(F):	-	136.0
Fan Total Static....(in.wg.):	-	0.25
Fan Efficiency...........(%):	-	54
Zone Terminal Type............:	CAV MBox	CAV MBox
Reheat Coil.................?	N	N
Diversity Factor...........(%):	100	100
Direct Exhaust Airflow...(CFM):	0.0	580.0
Direct Exhaust Fan kW.....(kW):	0.0	0.1

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? Y

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Central Cooling........						XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: AC-1002 Mech Rm & WCs 117-5 BL 11-08-94
Type: CONSTANT VOLUME - Multizone HAP v3.06
Prepared by: Keller & Gannon Page 1

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
39. 117-5: 3. Mechanical Rm	1		
SPACES IN ZONE 2 (Zone 2)			
40. 117-5: 4. Corridor	1	41. 117-5: 5. Janitor Room	1
42. 117-5: 6. Men's Toilet	1	43. 117-5: 7. Women's WC	1
44. 117-5: Wk/Mch Rm Plenum	1		

****

1. SYSTEM NAME AND TYPE

Name............:	AC-1002 Mech & WC 117-5 R1 & R2
Type............:	CONSTANT VOLUME - Multizone
Number of Zones.:	2

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Cold Deck Temperature.........:	85.0 F
Coil Bypass Factor............:	0.100
Cold Deck Reset...............:	Not Used
HEATING SYSTEM DATA	
Hot Deck Temperature..........:	70.0 F
Hot Deck Reset................:	Greatest Demand
Minimum Reset Temperature.....:	60.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Fan kW........................:	3.7 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	None
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

****

3. ZONE DATA

ZONE	1	2
T-Stat Occupied Cooling....(F):	90.0	90.0
Unoccupied Cooling..(F):	120.0	120.0
Occupied Heating....(F):	55.0	68.0
Unoccupied Heating..(F):	45.0	55.0
Throttling Range....(F):	3.0	3.0
Zone Heating Unit Type........:	None	Space FC
Trip Temperature.........(F):	-	-
Design Supply Temperature(F):	-	136.0
Fan Total Static....(in.wg.):	-	0.25
Fan Efficiency..........(%):	-	54
Zone Terminal Type............:	CAV MBox	CAV MBox
Reheat Coil.................?	N	N
Diversity Factor...........(%):	100	100
Direct Exhaust Airflow...(CFM):	0.0	580.0
Direct Exhaust Fan kW.....(kW):	0.0	0.1

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? Y

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Central Cooling........						XXX	XXX	XXX	XXX			

AIR SYSTEM INPUT DATA

Name: AC-1002 Mech & WC 117-5 R1 & R2 11-08-94
Type: CONSTANT VOLUME - Multizone HAP v3.06
Prepared by: Keller & Gannon

****

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
39. 117-5: 3. Mechanical Rm	1		
SPACES IN ZONE 2 (Zone 2)			
40. 117-5: 4. Corridor	1	41. 117-5: 5. Janitor Room	1
42. 117-5: 6. Men's Toilet	1	43. 117-5: 7. Women's WC	1
44. 117-5: Wk/Mch Rm Plenum	1		

****

1. SYSTEM NAME AND TYPE

Name............: AC-1002 Mech & WC 117-5 R3
Type............: CONSTANT VOLUME - Multizone
Number of Zones.: 2

===

2. SYSTEM DESCRIPTION

COOLING SYSTEM DATA	
Cold Deck Temperature.........:	85.0 F
Coil Bypass Factor............:	0.100
Cold Deck Reset...............:	Not Used
HEATING SYSTEM DATA	
Hot Deck Temperature..........:	70.0 F
Hot Deck Reset................:	Greatest Demand
Minimum Reset Temperature.....:	60.0 F
OUTDOOR VENTILATION DATA	
Type of Control...............:	Constant Airflow Rate
Design Ventilation Airflow....:	100 %
Dampers Open During Unocc Per.:	Y
SUPPLY DUCT DATA	
Duct Heat Gain................:	0 %
Duct Leakage Rate.............:	0 %
RETURN PLENUM DATA	
Is a Return Plenum Used.......?	N
SUPPLY FAN DATA	
Fan Type......................:	Forward Curved
Fan kW........................:	3.7 kW
RETURN FAN DATA	
Fan Type......................:	None
OUTDOOR AIR ECONOMIZER	
Outdoor Economizer Type.......:	None
PREHEAT COIL	
Preheat Coil Used.............?	N
PRECOOL COIL	
Precool Coil Used.............?	N
VENTILATION HEAT RECLAIM	
Reclaim Unit Type.............:	Sensible Only
Thermal Efficiency............:	70 %
Device Power Usage............:	0.2 kW
SAFETY FACTORS	
Sensible Cooling Factor.......:	0 %
Latent Cooling Factor.........:	0 %
Heating Factor................:	0 %

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3. ZONE DATA

ZONE	1	2
T-Stat Occupied Cooling....(F):	90.0	90.0
Unoccupied Cooling..(F):	120.0	120.0
Occupied Heating....(F):	55.0	68.0
Unoccupied Heating..(F):	45.0	55.0
Throttling Range....(F):	3.0	3.0
Zone Heating Unit Type........:	None	Space FC
Trip Temperature.........(F):	-	-
Design Supply Temperature(F):	-	136.0
Fan Total Static....(in.wg.):	-	0.00
Fan Efficiency...........(%):	-	54
Zone Terminal Type............:	CAV MBox	CAV MBox
Reheat Coil.................?	N	N
Diversity Factor...........(%):	100	100
Direct Exhaust Airflow...(CFM):	0.0	580.0
Direct Exhaust Fan kW.....(kW):	0.0	0.1

4. SCHEDULE DATA

HOURLY TSTAT SCHEDULES	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Design Day.............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Weekday................							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Saturday...............							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Sunday.................																								

Cooling Available During Unoccupied Period ? Y

MONTHLY SCHEDULES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Space/Skin Heating.....	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Central Heating........	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Central Cooling........						XXX	XXX	XXX	XXX			
Vent Reclaim Unit......	XXX	XXX	XXX	XXX	XXX				XXX	XXX	XXX	XXX

AIR SYSTEM INPUT DATA

Name: AC-1002 Mech & WC 117-5 R3 11-08-94
Type: CONSTANT VOLUME - Multizone HAP v3.06
Prepared by: Keller & Gannon

1. SPACE SELECTION

Space Name	Qty	Space Name	Qty
SPACES IN ZONE 1 (Zone 1)			
39. 117-5: 3. Mechanical Rm	1		
SPACES IN ZONE 2 (Zone 2)			
40. 117-5: 4. Corridor	1	41. 117-5: 5. Janitor Room	1
42. 117-5: 6. Men's Toilet	1	43. 117-5: 7. Women's WC	1
44. 117-5: Wk/Mch Rm Plenum	1		

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: Srvcs&Surt ACTUAL Cooler BL
Classification..............: Cooling
Type........................: Air-Cooled DX
Type of simulation model....: Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
2. UH-701. 2 Htrs,117-1 Mech Rm BL..	(2P-FC)	1
5. AC-701 ACTUAL Conditns,117-1 BL.	(DD CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	25.0 Tons
Compressor power at design.......:	34.0 kW
Outdoor fan power at design......:	3.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	40.0 F
Is low temperature control used..?	N

PLANT INPUT DATA

Plant: Services & Support Bdg Heating 12-20-94

Prepared By: Keller & Gannon Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	Services & Support Bdg Heating
Classification..............:	Heating
Type........................:	Steam Boiler
Notes.......................:	Remote source is the Boiler Plant 117-2
Notes.......................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
1. AC-701 117-1....................	-	1	-	-
2. UH-701. 2 Htrs,117-1 Mech Rm BL..	-	1	-	-

STEAM BOILER DATA

Estimated maximum heating load...:	NA
Gross output at design...........:	9826.8 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	60.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	2.000 kW
Fuel oil pump kW.................:	0.500 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	60.0	40	60.0
80	60.0	30	60.0
70	60.0	20	60.0
60	60.0	10	60.0
50	60.0	0	60.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Steam	-	-	-	-	-	0.0

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	Elec Supply HC-702, 117-1 BL
Classification..............:	Heating
Type........................:	Electric Resistance
Notes.......................:	Electric Supply to HC-702,
Notes.......................:	Annex Tempering Air System (Freeze Prot)

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
3. Anex Fan&Elec Htg Coil, 117-1 BL.	1	-	-	-

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	Srvcs&Surt ACTUAL Cooler R1
Classification..............:	Cooling
Type........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
14. UH-701. 2 Htrs,117-1 Mech Rm R1..	(2P-FC)	1
15. AC-701 ACTUAL Conditns,117-1 R1.	(DD CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	25.0 Tons
Compressor power at design.......:	34.0 kW
Outdoor fan power at design......:	3.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	40.0 F
Is low temperature control used..?	N

PLANT NAME, CLASSIFICATION & TYPE

Plant name	Srvcs & Spprt Bdg Heating R1
Classification	Heating
Type	Hot Water Boiler
Notes	Remote source is the Boiler Plant 117-2
Notes	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
14. UH-701. 2 Htrs,117-1 Mech Rm R1..	-	1	-	-
15. AC-701 ACTUAL Conditns,117-1 R1.	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load	NA
Gross output at design	9007.9 MBH
Energy input at design	16378.0 MBH
Overall efficiency at design	55.0 %
Fuel or energy type	Fuel Oil
Combustion air blower kW	0.200 kW
Fuel oil pump kW	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	237.8	20.00	85.0	90.0	0.37	2.0

PLANT NAME, CLASSIFICATION & TYPE

Plant name	Srvcs & Spprt Bdg Heating BL
Classification	Heating
Type	Hot Water Boiler
Notes	Remote source is the Boiler Plant 117-2
Notes	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
2. UH-701. 2 Htrs,117-1 Mech Rm BL..	-	1	-	-
5. AC-701 ACTUAL Conditns,117-1 BL.	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load	NA
Gross output at design	9007.9 MBH
Energy input at design	16378.0 MBH
Overall efficiency at design	55.0 %
Fuel or energy type	Fuel Oil
Combustion air blower kW	0.200 kW
Fuel oil pump kW	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	237.8	20.00	85.0	90.0	0.37	2.0

PLANT INPUT DATA

Plant: 117-3 CA-601 A/C DX Cooling BL 12-20-94

Prepared By: Keller & Gannon Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	117-3 CA-601 A/C DX Cooling BL
Classification..............:	Cooling
Type........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
6. AC-601, Control Room, 117-3 BL...	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	5.0 Tons
Compressor power at design.......:	6.5 kW
Outdoor fan power at design......:	0.1 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT INPUT DATA

Plant: 117-3 Stm-Glycol AC-601 BL 12-20-94

Prepared By: Keller & Gannon Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-3 Stm-Glycol AC-601 BL
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
6. AC-601, Control Room, 117-3 BL...	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...: NA
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	59.4	20.00	85.0	90.0	1.49	2.0

PLANT INPUT DATA

Plant: 117-3 CA-601 A/C DX Cooling R1 12-20-94

Prepared By: Keller & Gannon Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name...................:	117-3 CA-601 A/C DX Cooling R1
Classification...............:	Cooling
Type.........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
16. AC-601, Control Room, 117-3 R1...	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	5.0 Tons
Compressor power at design.......:	6.5 kW
Outdoor fan power at design......:	0.1 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................	117-3 Stm-Glycol AC-601 R1
Classification..............	Heating
Type........................	Hot Water Boiler
Notes.......................	Remote source is the Boiler Plant 117-2
Notes.......................	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
16. AC-601, Control Room, 117-3 R1...	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...:	NA
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	59.4	20.00	85.0	90.0	1.49	2.0

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-3 CA-602 A/C DX Cooling BL
Classification..............: Cooling
Type........................: Air-Cooled DX
Type of simulation model....: Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
7. AC-602, Work Corridor, 117-3 BL..	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA	
Design OAT.......................:	97.0	F
Gross cooling capacity...........:	10.0	Tons
Compressor power at design.......:	13.0	kW
Outdoor fan power at design......:	0.3	kW
Crankcase heater kW..............:	0.000	kW
Cyclic degradation factor........:	0.150	
Conventional minimum ambient.....:	55.0	F
Is low temperature control used..?	N	

PLANT INPUT DATA

Plant: 117-3 Stm-Glycol AC-602 BL 12-20-94

Prepared By: Keller & Gannon Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-3 Stm-Glycol AC-602 BL
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
7. AC-602, Work Corridor, 117-3 BL..	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...: NA
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	17.7	20.00	85.0	90.0	5.00	2.0

PLANT INPUT DATA

Plant: 117-3 CA-602 A/C DX Cooling R1 — 12-20-94

Prepared By: Keller & Gannon —

PLANT NAME, CLASSIFICATION & TYPE

Plant name.................:	117-3 CA-602 A/C DX Cooling R1
Classification.............:	Cooling
Type.......................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
17. AC-602, Work Corridor, 117-3 R1..	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	10.0 Tons
Compressor power at design.......:	13.0 kW
Outdoor fan power at design......:	0.3 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT INPUT DATA

Plant: 117-3 Stm-Glycol AC-602 R1 12-20-94

Prepared By: Keller & Gannon Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-3 Stm-Glycol AC-602 R1
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
17. AC-602, Work Corridor, 117-3 R1..	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...: NA
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	17.7	20.00	85.0	90.0	5.00	2.0

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name...................:	117-3 CA-602 A/C DX Cooling R2
Classification...............:	Cooling
Type.........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
28. AC-602, Work Corridor, 117-3 R2..	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	10.0 Tons
Compressor power at design.......:	13.0 kW
Outdoor fan power at design......:	0.3 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT INPUT DATA

Plant: 117-3 Stm-Glycol AC-602 R2 12-20-94
Prepared By: Keller & Gannon Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name...................:	117-3 Stm-Glycol AC-602 R2
Classification...............:	Heating
Type.........................:	Hot Water Boiler
Notes........................:	Remote source is the Boiler Plant 117-2
Notes........................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
28. AC-602, Work Corridor, 117-3 R2..	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...:	NA
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	17.7	20.00	85.0	90.0	5.00	2.0

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	117-3 CA-602 A/C DX Coolng R2B
Classification..............:	Cooling
Type........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
29. AC-602, Work Corridor, 117-3 R2B.	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	40.4 Tons
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	10.0 Tons
Compressor power at design.......:	13.0 kW
Outdoor fan power at design......:	0.3 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT INPUT DATA

Plant: 117-3 Stm-Glycol AC-602 R2B — 12-20-94

Prepared By: Keller & Gannon — Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name	117-3 Stm-Glycol AC-602 R2B
Classification	Heating
Type	Hot Water Boiler
Notes	Remote source is the Boiler Plant 117-2
Notes	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

	Heating Coil Category			
Air System Name	Pre-Heat	Central	Terminal	Zone
29. AC-602, Work Corridor, 117-3 R2B.	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load	647.2 MBH
Gross output at design	9007.9 MBH
Energy input at design	16378.0 MBH
Overall efficiency at design	55.0 %
Fuel or energy type	Fuel Oil
Combustion air blower kW	0.200 kW
Fuel oil pump kW	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	17.7	20.00	85.0	90.0	5.00	2.0

PLANT INPUT DATA

Plant: 117-3 Stm-Glycol HV-601 BL 12-20-94

Prepared By: Keller & Gannon Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-3 Stm-Glycol HV-601 BL
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
8. HV-601 Mech Rm H&V Unit 117-3 BL.	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...: NA
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	18.6	20.00	85.0	90.0	4.77	2.0

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name...................:	117-3 Stm-Glycol HV-601 R1
Classification...............:	Heating
Type.........................:	Hot Water Boiler
Notes........................:	Remote source is the Boiler Plant 117-2
Notes........................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
18. HV-601 Mech Rm H&V Unit 117-3 R1.	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...:	NA
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	18.6	20.00	85.0	90.0	4.77	2.0

PLANT INPUT DATA

Plant: 117-5 Work Room A/C DX Unit BL — 12-20-94
Prepared By: Keller & Gannon — Page 1

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-5 Work Room A/C DX Unit BL
Classification..............: Cooling
Type........................: Air-Cooled DX
Type of simulation model....: Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
10. AC-1001 Work Room 117-5 BASELINE.	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	35.0 Tons
Compressor power at design.......:	56.3 kW
Outdoor fan power at design......:	5.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT INPUT DATA

Plant: 117-5 Work Rm A/C DX Unit R1 — 12-20-94

Prepared By: Keller & Gannon — Page 1

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	117-5 Work Rm A/C DX Unit R1
Classification..............:	Cooling
Type........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
20. AC-1001 Work Room 117-5 R1.......	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	35.0 Tons
Compressor power at design.......:	56.3 kW
Outdoor fan power at design......:	5.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	117-5 Work Rm A/C-DX Unit R2
Classification..............:	Cooling
Type........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
27. AC-1001 Work Room 117-5 R2.......	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	33.0 Tons
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	35.0 Tons
Compressor power at design.......:	56.3 kW
Outdoor fan power at design......:	5.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	117-5 Work Room A/C-DX Unit R3
Classification..............:	Cooling
Type........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
21. AC-1001 Work Room 117-5 R3.......	(SZ CAV)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	24.8 Tons
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	35.0 Tons
Compressor power at design.......:	56.3 kW
Outdoor fan power at design......:	5.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.150
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name....................:	117-5 Stm-Glycol AC-1001 BL
Classification................:	Heating
Type..........................:	Hot Water Boiler
Notes.........................:	Remote source is the Boiler Plant 117-2
Notes.........................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
10. AC-1001 Work Room 117-5 BASELINE.	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...:	939.5 MBH
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	139.9	40.00	85.0	90.0	1.27	2.0

PLANT INPUT DATA

Plant: 117-5 Stm-Glycol AC-1001 R1 12-20-94

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****

PLANT NAME, CLASSIFICATION & TYPE

Plant name.................:	117-5 Stm-Glycol AC-1001 R1
Classification.............:	Heating
Type.......................:	Hot Water Boiler
Notes......................:	Remote source is the Boiler Plant 117-2
Notes......................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
20. AC-1001 Work Room 117-5 R1.......	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...:	813.0 MBH
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	139.9	40.00	85.0	90.0	1.27	2.0

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-5 Stm/Glycol AC-1001 R2
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
27. AC-1001 Work Room 117-5 R2.......	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...: 805.1 MBH
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	139.9	40.00	85.0	90.0	1.27	2.0

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-5 Stm / Glycol AC-1001 R3
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
21. AC-1001 Work Room 117-5 R3.......	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...: 443.9 MBH
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	139.9	40.00	85.0	90.0	1.27	2.0

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-5 Stm-Glycol AC-1002 BL
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
11. AC-1002 Mech Rm & WCs 117-5 BL...	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...: NA
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	443.5	40.00	85.0	90.0	0.40	2.0

PLANT INPUT DATA

Plant: 117-5 Stm-Glycol AC-1002 R1 — 12-20-94

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PLANT NAME, CLASSIFICATION & TYPE

Plant name...................:	117-5 Stm-Glycol AC-1002 R1
Classification...............:	Heating
Type.........................:	Hot Water Boiler
Notes........................:	Remote source is the Boiler Plant 117-2
Notes........................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
22. AC-1002 Mech & WC 117-5 R1 & R2..	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...:	NA
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	443.5	40.00	85.0	90.0	0.40	2.0

PLANT INPUT DATA

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-5 Stm-Glycol AC-1002 R2
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
22. AC-1002 Mech & WC 117-5 R1 & R2..	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...: NA
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	443.5	40.00	85.0	90.0	0.40	2.0

PLANT INPUT DATA

Plant: 117-5 Stm-Glycol AC-1002 R3 — 12-20-94

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PLANT NAME, CLASSIFICATION & TYPE

Plant name.................:	117-5 Stm-Glycol AC-1002 R3
Classification.............:	Heating
Type.......................:	Hot Water Boiler
Notes......................:	Remote source is the Boiler Plant 117-2
Notes......................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
23. AC-1002 Mech & WC 117-5 R3.......	-	1	-	1

HOT WATER BOILER DATA

Estimated maximum heating load...:	NA
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	443.5	40.00	85.0	90.0	0.40	2.0

PLANT INPUT DATA

Plant: 117-5 Stm-Glycol UH-1001 BL 12-20-94

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-5 Stm-Glycol UH-1001 BL
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

	Heating Coil	Category		
Air System Name	Pre-Heat	Central	Terminal	Zone
13. UH-1001. 2 Htrs,117-5 Mech Rm BL.	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...: 81.6 MBH
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Efficiencies Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	%1478.2	40.00	85.0	90.0	0.12	2.0

****

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-5 Stm-Glycol UH-1001 R1
Classification..............: Heating
Type........................: Hot Water Boiler
Notes.......................: Remote source is the Boiler Plant 117-2
Notes.......................: Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
26. UH-1001 Htrs,117-5 Mech BL R12&3.	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...: 81.6 MBH
Gross output at design...........: 9007.9 MBH
Energy input at design...........: 16378.0 MBH
Overall efficiency at design.....: 55.0 %
Fuel or energy type..............: Fuel Oil
Combustion air blower kW.........: 0.200 kW
Fuel oil pump kW.................: 0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	%1478.2	40.00	85.0	90.0	0.12	2.0

PLANT INPUT DATA

Plant: 117-5 Stm-Glycol HV-1001 R2 12-20-94

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PLANT NAME, CLASSIFICATION & TYPE

Plant name.................:	117-5 Stm-Glycol HV-1001 R2
Classification.............:	Heating
Type.......................:	Hot Water Boiler
Notes......................:	Remote source is the Boiler Plant 117-2
Notes......................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
26. UH-1001 Htrs,117-5 Mech BL R12&3.	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...:	81.6 MBH
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	%1478.2	40.00	85.0	90.0	0.12	2.0

PLANT INPUT DATA

Plant: 117-5 Stm-Glycol HV-1001 R3 12-20-94

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	117-5 Stm-Glycol HV-1001 R3
Classification..............:	Heating
Type........................:	Hot Water Boiler
Notes.......................:	Remote source is the Boiler Plant 117-2
Notes.......................:	Steam supplied to HtEX in Blr Rm @ 15psi

AIR SYSTEM SELECTIONS

Air System Name	Heating Coil Category Pre-Heat	Central	Terminal	Zone
26. UH-1001 Htrs,117-5 Mech BL R12&3.	-	1	-	-

HOT WATER BOILER DATA

Estimated maximum heating load...:	81.6 MBH
Gross output at design...........:	9007.9 MBH
Energy input at design...........:	16378.0 MBH
Overall efficiency at design.....:	55.0 %
Fuel or energy type..............:	Fuel Oil
Combustion air blower kW.........:	0.200 kW
Fuel oil pump kW.................:	0.050 kW

BOILER PART-LOAD PERFORMANCE DATA

% Load	Overall Eff. (%)	% Load	Overall Eff. (%)
90	55.0	40	55.0
80	55.0	30	55.0
70	55.0	20	55.0
60	55.0	10	55.0
50	55.0	0	55.0

PUMP AND PIPING SYSTEM DATA

Pump or Piping System	Delta-T (F)	Pump Head (ft wg)	Efficiencies Mech (%)	Elec (%)	Pump Power (kW)	Piping Gain/Loss (%)
Hot Water	%1478.2	40.00	85.0	90.0	0.12	2.0

PLANT NAME, CLASSIFICATION & TYPE

Plant name.................:	117-5 Non Egy Use DX Unit BL
Classification.............:	Cooling
Type.......................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
11. AC-1002 Mech Rm & WCs 117-5 BL...	(MZ)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	0.0 Tons
Compressor power at design.......:	0.0 kW
Outdoor fan power at design......:	0.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.000
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT NAME, CLASSIFICATION & TYPE

Plant name..................:	117-5 Non Egy Use DX Unit R1
Classification..............:	Cooling
Type........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
22. AC-1002 Mech & WC 117-5 R1 & R2..	(MZ)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	0.0 Tons
Compressor power at design.......:	0.0 kW
Outdoor fan power at design......:	0.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.000
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT INPUT DATA

Plant: 117-5 Non Egy Use DX Unit R2 — 12-20-94

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PLANT NAME, CLASSIFICATION & TYPE

Plant name..................: 117-5 Non Egy Use DX Unit R2
Classification..............: Cooling
Type........................: Air-Cooled DX
Type of simulation model....: Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
19. Infilt Drs Open-Wk Rm 117-5 R2&3.	(SIM CAV)	1
22. AC-1002 Mech & WC 117-5 R1 & R2..	(MZ)	1
24. WINTER AC-1002 Mch&WC 117-5 R1&2.	(MZ)	1
26. UH-1001 Htrs,117-5 Mech BL R12&3.	(2P-FC)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	0.0 Tons
Compressor power at design.......:	0.0 kW
Outdoor fan power at design......:	0.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.000
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

PLANT INPUT DATA

Plant: 117-5 Non Egy Use DX Unit R3 12-20-94

Prepared By: Keller & Gannon Page 1

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PLANT NAME, CLASSIFICATION & TYPE

Plant name...................:	117-5 Non Egy Use DX Unit R3
Classification...............:	Cooling
Type.........................:	Air-Cooled DX
Type of simulation model....:	Computer-Generated

AIR SYSTEM SELECTIONS

Air System Name	Type	Quantity
23. AC-1002 Mech & WC 117-5 R3.......	(MZ)	1

AIR-COOLED DX COOLING DATA

COOLING DATA

Estimated maximum cooling load...:	NA
Design OAT.......................:	97.0 F
Gross cooling capacity...........:	0.0 Tons
Compressor power at design.......:	0.0 kW
Outdoor fan power at design......:	0.0 kW
Crankcase heater kW..............:	0.000 kW
Cyclic degradation factor........:	0.000
Conventional minimum ambient.....:	55.0 F
Is low temperature control used..?	N

BUILDING INPUT DATA

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BUILDING NAME..........: Srvcs&Supprt ACTUAL 117-1 BL

PLANT SELECTION

	Plant Name	Type	Quantity
2.	Srvcs&Surt ACTUAL Cooler BL....	(A/C DX CLG)	1
4.	Elec Supply HC-702, 117-1 BL...	(ELEC HTG)	1
13.	Srvcs & Spprt Bdg Heating BL...	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area....................:	0.0 sqft
Source electric generating efficiency.............:	100.00 %

BUILDING INPUT DATA

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BUILDING NAME..........: Srvcs&Supprt ACTUAL 117-1 R1

PLANT SELECTION

	Plant Name	Type	Quantity
4.	Elec Supply HC-702, 117-1 BL...	(ELEC HTG)	1
11.	Srvcs&Surt ACTUAL Cooler R1....	(A/C DX CLG)	1
12.	Srvcs & Spprt Bdg Heating R1...	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate..................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area....................:	0.0 sqft
Source electric generating efficiency.............:	100.00 %

BUILDING INPUT DATA

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BUILDING NAME..........: 117-3. Control Room Area BL

PLANT SELECTION

	Plant Name	Type	Quantity
5.	117-3 CA-601 A/C DX Cooling BL.	(A/C DX CLG)	1
6.	117-3 Stm-Glycol AC-601 BL.....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

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BUILDING NAME..........: 117-3. Control Room Area R1

PLANT SELECTION

Plant Name	Type	Quantity
14. 117-3 CA-601 A/C DX Cooling R1.	(A/C DX CLG)	1
15. 117-3 Stm-Glycol AC-601 R1.....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company

Average building power factor.: NA

FUEL RATES

Natural gas...................: None

Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil

Propane.......................: None

Remote source heating.........: None

Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft

Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

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BUILDING NAME..........: 117-3. Work Areas BL

PLANT SELECTION

	Plant Name	Type	Quantity
7.	117-3 CA-602 A/C DX Cooling BL.	(A/C DX CLG)	1
26.	117-3 Stm-Glycol AC-602 BL.....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

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BUILDING NAME..........: 117-3. Work Areas R1

PLANT SELECTION

Plant Name	Type	Quantity
16. 117-3 CA-602 A/C DX Cooling R1.	(A/C DX CLG)	1
28. 117-3 Stm-Glycol AC-602 R1.....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate..................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

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BUILDING NAME..........: 117-3. Work Areas R2

PLANT SELECTION

	Plant Name	Type	Quantity
38.	117-3 CA-602 A/C DX Cooling R2.	(A/C DX CLG)	1
39.	117-3 Stm-Glycol AC-602 R2.....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

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BUILDING NAME..........: 117-3. Work Areas R2B

PLANT SELECTION

	Plant Name	Type	Quantity
40.	117-3 CA-602 A/C DX Coolng R2B.	(A/C DX CLG)	1
41.	117-3 Stm-Glycol AC-602 R2B....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon — 12-20-94

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BUILDING NAME..........: 117-3. Mechanical Room BL

PLANT SELECTION

Plant Name	Type	Quantity
27. 117-3 Stm-Glycol HV-601 BL.....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas..................: None
Fuel oil.....................: Hawthorne - LS No. 2 Fuel Oil
Propane......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

HAP v3.06

BUILDING NAME..........: 117-3. Mechanical Room R1

PLANT SELECTION

Plant Name	Type	Quantity
29. 117-3 Stm-Glycol HV-601 R1.....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area..................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

BUILDING NAME..........: 117-5. Work Room HVAC BL

PLANT SELECTION

	Plant Name	Type	Quantity
8.	117-5 Stm-Glycol AC-1001 BL....	(HW BOILER)	1
9.	117-5 Work Room A/C DX Unit BL.	(A/C DX CLG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

HAP v3.06 Page 1

BUILDING NAME..........: 117-5. Work Room HVAC R1

PLANT SELECTION

Plant Name	Type	Quantity
17. 117-5 Stm-Glycol AC-1001 R1....	(HW BOILER)	1
19. 117-5 Work Rm A/C DX Unit R1...	(A/C DX CLG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

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BUILDING NAME..........: 117-5. Work Room HVAC R2

PLANT SELECTION

	Plant Name	Type	Quantity
24.	117-5 Work Rm A/C-DX Unit R2...	(A/C DX CLG)	1
25.	117-5 Stm/Glycol AC-1001 R2....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company

Average building power factor.: NA

FUEL RATES

Natural gas...................: None

Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil

Propane.......................: None

Remote source heating.........: None

Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft

Source electric generating efficiency............: 100.00 %

****

BUILDING NAME..........: 117-5. Work Room HVAC R3

PLANT SELECTION

Plant Name	Type	Quantity
18. 117-5 Stm / Glycol AC-1001 R3..	(HW BOILER)	1
20. 117-5 Work Room A/C-DX Unit R3.	(A/C DX CLG)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area..................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING NAME..........: 117-5. Mech Room & WCs BL

PLANT SELECTION

Plant Name	Type	Quantity
10. 117-5 Non Egy Use DX Unit BL...	(A/C DX CLG)	1
30. 117-5 Stm-Glycol AC-1002 BL....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon — 12-20-94

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BUILDING NAME..........: 117-5. Mech Room & WCs R1

PLANT SELECTION

	Plant Name	Type	Quantity
21.	117-5 Non Egy Use DX Unit R1...	(A/C DX CLG)	1
32.	117-5 Stm-Glycol AC-1002 R1....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

****

BUILDING NAME..........: 117-5. Mech Room & WCs R2

PLANT SELECTION

Plant Name	Type	Quantity
22. 117-5 Non Egy Use DX Unit R2...	(A/C DX CLG)	1
34. 117-5 Stm-Glycol AC-1002 R2....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate.................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

BUILDING INPUT DATA

Prepared by: Keller & Gannon 12-20-94

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BUILDING NAME..........: 117-5. Mech Room & WCs R3

PLANT SELECTION

	Plant Name	Type	Quantity
2[illegible].	117-5 Non Egy Use DX Unit R3...	(A/C DX CLG)	1
36.	117-5 Stm-Glycol AC-1002 R3....	(HW BOILER)	1

MISCELLANEOUS ELECTRIC POWER USE

Reference Name	Max. Power Use (kW)	Schedule Name
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA
Empty...	0.0	NA

MISCELLANEOUS FUEL USE

Reference Name	Fuel Type	Fuel Units	Conversion kBTU/Units	Max. Use	Schedule Name
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA
Empty...	NG	THM	100.0000	0.0	NA

Fuel Types: NG=Nat.Gas FO=Fuel Oil PR=Propane RH=Rmt Htg

ELECTRIC RATE

Electric rate................: Sierra Pacific Power Company
Average building power factor.: NA

FUEL RATES

Natural gas...................: None
Fuel oil......................: Hawthorne - LS No. 2 Fuel Oil
Propane.......................: None
Remote source heating.........: None
Remote source cooling.........: None

MISCELLANEOUS DATA

Additional building floor area...................: 0.0 sqft
Source electric generating efficiency............: 100.00 %

ENERGY BUDGET BY SYSTEM COMPONENT

Building: Srvcs&Supprt ACTUAL 117-1 BL 11-07-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon Page 1 of 1

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	425307	46.325
Heating Loads	562741	61.294

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	180024	19.608	180024	19.608
Cooling Plants	140714	15.327	140714	15.327
Absorption Chillers	0	0.000	0	0.000
Heating Plants	1014201	110.467	1014201	110.467
Pumps	11149	1.214	11149	1.214
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	1346087	146.617	1346087	146.617
Lights	319714	34.823	319714	34.823
Electric Equipment	527638	57.471	527638	57.471
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	847352	92.294	847352	92.294
>>> GRAND TOTAL	2193439	238.911	2193439	238.911

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9181 sqft
  Conditioned floor area..........: 9181 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Srvcs&Supprt ACTUAL 117-1 BL 11-07-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	425307	46.325
Heating Loads	562741	61.294

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	356779	38.861	356779	38.861
Natural Gas	0	0.000	0	0.000
Fuel Oil	989308	107.756	989308	107.756
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	1346087	146.617	1346087	146.617
Electric	847352	92.294	847352	92.294
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	847352	92.294	847352	92.294
>>> GRAND TOTAL	2193439	238.911	2193439	238.911

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9181 sqft
  Conditioned floor area..........: 9181 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: Srvcs&Supprt ACTUAL 117-1 R1 11-07-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon Page 1 of 1

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	255797	27.862
Heating Loads	374090	40.746

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	182856	19.917	182856	19.917
Cooling Plants	93228	10.154	93228	10.154
Absorption Chillers	0	0.000	0	0.000
Heating Plants	664642	72.393	664642	72.393
Pumps	11149	1.214	11149	1.214
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	951875	103.679	951875	103.679
Lights	319714	34.823	319714	34.823
Electric Equipment	527638	57.471	527638	57.471
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	847352	92.294	847352	92.294
>>> GRAND TOTAL	1799226	195.973	1799226	195.973

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9181 sqft
  Conditioned floor area..........: 9181 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: Srvcs&Supprt ACTUAL 117-1 R1 — 11-07-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	255797	27.862
Heating Loads	374090	40.746

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	Site Energy * (kBTU)	Site Energy * (kBTU/sqft)*	Source Energy * (kBTU)	Source Energy * (kBTU/sqft)*
Electric	312108	33.995	312108	33.995
Natural Gas	0	0.000	0	0.000
Fuel Oil	639767	69.684	639767	69.684
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	951875	103.679	951875	103.679
Electric	847352	92.294	847352	92.294
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	847352	92.294	847352	92.294
>>> GRAND TOTAL	1799227	195.973	1799227	195.973

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
Gross floor area................: 9181 sqft
Conditioned floor area..........: 9181 sqft

DESIGN BASELINE

ENERGY BUDGET BY SYSTEM COMPONENT

Building: Services & Support Bldg. 117-1 11-01-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon Page 1 of 1

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	311484	33.927
Heating Loads	578600	63.021

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	172267	18.763	172267	18.763
Cooling Plants	104352	11.366	104352	11.366
Absorption Chillers	0	0.000	0	0.000
Heating Plants	1043662	113.676	1043662	113.676
Pumps	11149	1.214	11149	1.214
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	1331430	145.020	1331430	145.020
Lights	319714	34.823	319714	34.823
Electric Equipment	527638	57.471	527638	57.471
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	847352	92.294	847352	92.294
>>> GRAND TOTAL	2178782	237.314	2178782	237.314

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9181 sqft
  Conditioned floor area..........: 9181 sqft

DESIGN BASELINE

ENERGY BUDGET BY ENERGY SOURCE

Building: Services & Support Bldg. 117-1 — 11-01-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	311484	33.927
Heating Loads	578600	63.021

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	312662	34.055	312662	34.055
Natural Gas	0	0.000	0	0.000
Fuel Oil	1018768	110.965	1018768	110.965
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	1331430	145.020	1331430	145.020
Electric	847352	92.294	847352	92.294
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	847352	92.294	847352	92.294
>>> GRAND TOTAL	2178782	237.314	2178782	237.314

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9181 sqft
  Conditioned floor area..........: 9181 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Control Room Area BL — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	63601	37.172
Heating Loads	54405	31.797

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Air System Fans	26514	15.496	26514	15.496
Cooling Plants	19699	11.513	19699	11.513
Absorption Chillers	0	0.000	0	0.000
Heating Plants	84373	49.312	84373	49.312
Pumps	17171	10.036	17171	10.036
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	147757	86.357	147757	86.357
Lights	68896	40.266	68896	40.266
Electric Equipment	76064	44.456	76064	44.456
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	144960	84.722	144960	84.722
>>> GRAND TOTAL	292717	171.080	292717	171.080

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 1711 sqft
  Conditioned floor area..........: 1711 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Control Room Area BL 11-08-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	63601	37.172
Heating Loads	54405	31.797

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	Site Energy* (kBTU)	Site Energy* (kBTU/sqft)*	Source Energy* (kBTU)	Source Energy* (kBTU/sqft)*
Electric	63389	37.048	63389	37.048
Natural Gas	0	0.000	0	0.000
Fuel Oil	84368	49.309	84368	49.309
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	147757	86.357	147757	86.357
Electric	144960	84.722	144960	84.722
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	144960	84.722	144960	84.722
>>> GRAND TOTAL	292717	171.080	292717	171.080

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
Gross floor area...............: 1711 sqft
Conditioned floor area..........: 1711 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Control Room Area R1 — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	48760	28.498
Heating Loads	53562	31.305

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	26514	15.496	26514	15.496
Cooling Plants	15804	9.237	15804	9.237
Absorption Chillers	0	0.000	0	0.000
Heating Plants	82135	48.004	82135	48.004
Pumps	16942	9.902	16942	9.902
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	141395	82.639	141395	82.639
Lights	68896	40.266	68896	40.266
Electric Equipment	76064	44.456	76064	44.456
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	144960	84.722	144960	84.722
>>> GRAND TOTAL	286355	167.361	286355	167.361

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 1711 sqft
  Conditioned floor area..........: 1711 sqft

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	48760	28.498
Heating Loads	53562	31.305

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	59264	34.637	59264	34.637
Natural Gas	0	0.000	0	0.000
Fuel Oil	82131	48.002	82131	48.002
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	141395	82.639	141395	82.639
Electric	144960	84.722	144960	84.722
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	144960	84.722	144960	84.722
>>> GRAND TOTAL	286355	167.361	286355	167.361

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 1711 sqft
  Conditioned floor area..........: 1711 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Work Areas BL 11-23-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	601501	64.664
Heating Loads	145921	15.687

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Air System Fans	63736	6.852	63736	6.852
Cooling Plants	72712	7.817	72712	7.817
Absorption Chillers	0	0.000	0	0.000
Heating Plants	232778	25.025	232778	25.025
Pumps	56755	6.101	56755	6.101
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	425982	45.795	425982	45.795
Lights	266135	28.610	266135	28.610
Electric Equipment	1215471	130.668	1215471	130.668
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1907588	205.073	1907588	205.073

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9302 sqft
  Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Work Areas BL — 11-23-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	601501	64.664
Heating Loads	145921	15.687

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *---->		<---- Source Energy *--->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	193215	20.771	193215	20.771
Natural Gas	0	0.000	0	0.000
Fuel Oil	232766	25.023	232766	25.023
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	425982	45.795	425982	45.795
Electric	1481606	159.278	1481606	159.278
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1907588	205.073	1907588	205.073

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 9302 sqft
  Conditioned floor area.........: 9302 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Work Areas R1 — 11-23-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	483293	51.956
Heating Loads	88944	9.562

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	63736	6.852	63736	6.852
Cooling Plants	70043	7.530	70043	7.530
Absorption Chillers	0	0.000	0	0.000
Heating Plants	136883	14.715	136883	14.715
Pumps	56755	6.101	56755	6.101
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	327417	35.199	327417	35.199
Lights	266135	28.610	266135	28.610
Electric Equipment	1215471	130.668	1215471	130.668
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1809023	194.477	1809023	194.477

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9302 sqft
  Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Work Areas R1 11-23-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	483293	51.956
Heating Loads	88944	9.562

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	Site Energy * (kBTU)	Site Energy * (kBTU/sqft)*	Source Energy * (kBTU)	Source Energy * (kBTU/sqft)*
Electric	190541	20.484	190541	20.484
Natural Gas	0	0.000	0	0.000
Fuel Oil	136876	14.715	136876	14.715
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	327417	35.199	327417	35.199
Electric	1481606	159.278	1481606	159.278
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1809024	194.477	1809024	194.477

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 9302 sqft
  Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Work Areas R2 11-23-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	525347	56.477
Heating Loads	50311	5.409

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	225564	24.249	225564	24.249
Natural Gas	0	0.000	0	0.000
Fuel Oil	72532	7.797	72532	7.797
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	298096	32.046	298096	32.046
Electric	1481606	159.278	1481606	159.278
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1779702	191.325	1779702	191.325

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 9302 sqft
  Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Work Areas R2 11-23-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	525347	56.477
Heating Loads	50311	5.409

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	<----- Site Energy *---->		<---- Source Energy *--->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	97022	10.430	97022	10.430
Cooling Plants	71783	7.717	71783	7.717
Absorption Chillers	0	0.000	0	0.000
Heating Plants	72536	7.798	72536	7.798
Pumps	56755	6.101	56755	6.101
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	298096	32.046	298096	32.046
Lights	266135	28.610	266135	28.610
Electric Equipment	1215471	130.668	1215471	130.668
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1779702	191.325	1779702	191.325

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9302 sqft
  Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Work Areas R2B 11-23-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	484213	52.055
Heating Loads	879	0.094

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	191702	20.609	191702	20.609
Natural Gas	0	0.000	0	0.000
Fuel Oil	970	0.104	970	0.104
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	192672	20.713	192672	20.713
Electric	1481606	159.278	1481606	159.278
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1674279	179.991	1674279	179.991

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 9302 sqft
  Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Work Areas R2B — 11-23-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	484213	52.055
Heating Loads	879	0.094

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	Site Energy * (kBTU)	Site Energy * (kBTU/sqft)*	Source Energy * (kBTU)	Source Energy * (kBTU/sqft)*
Air System Fans	64804	6.967	64804	6.967
Cooling Plants	70144	7.541	70144	7.541
Absorption Chillers	0	0.000	0	0.000
Heating Plants	970	0.104	970	0.104
Pumps	56755	6.101	56755	6.101
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	192672	20.713	192672	20.713
Lights	266135	28.610	266135	28.610
Electric Equipment	1215471	130.668	1215471	130.668
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1674278	179.991	1674278	179.991

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9302 sqft
  Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Mechanical Room BL — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501425	170.321

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	50990	17.320	50990	17.320
Cooling Plants	0	0.000	0	0.000
Absorption Chillers	0	0.000	0	0.000
Heating Plants	841306	285.770	841306	285.770
Pumps	54214	18.415	54214	18.415
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	946510	321.505	946510	321.505
Lights	57653	19.583	57653	19.583
Electric Equipment	615955	209.224	615955	209.224
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	673607	228.807	673607	228.807
>>> GRAND TOTAL	1620117	550.312	1620117	550.312

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2944 sqft
  Conditioned floor area..........: 2944 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Mechanical Room BL 11-08-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501425	170.321

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	105248	35.750	105248	35.750
Natural Gas	0	0.000	0	0.000
Fuel Oil	841262	285.755	841262	285.755
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	946510	321.505	946510	321.505
Electric	673607	228.807	673607	228.807
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	673607	228.807	673607	228.807
>>> GRAND TOTAL	1620117	550.311	1620117	550.311

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 2944 sqft
  Conditioned floor area..........: 2944 sqft

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501312	170.283

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	50989	17.320	50989	17.320
Cooling Plants	0	0.000	0	0.000
Absorption Chillers	0	0.000	0	0.000
Heating Plants	841097	285.699	841097	285.699
Pumps	54214	18.415	54214	18.415
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	946300	321.433	946300	321.433
Lights	57653	19.583	57653	19.583
Electric Equipment	615955	209.224	615955	209.224
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	673607	228.807	673607	228.807
>>> GRAND TOTAL	1619907	550.240	1619907	550.240

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 2944 sqft
  Conditioned floor area..........: 2944 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Mechanical Room R1 — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501312	170.283

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	105247	35.750	105247	35.750
Natural Gas	0	0.000	0	0.000
Fuel Oil	841053	285.684	841053	285.684
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	946300	321.433	946300	321.433
Electric	673607	228.807	673607	228.807
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	673607	228.807	673607	228.807
>>> GRAND TOTAL	1619907	550.240	1619907	550.240

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2944 sqft
  Conditioned floor area..........: 2944 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Work Room HVAC BL — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	304859	82.865
Heating Loads	1806123	490.928

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	116280	31.606	116280	31.606
Cooling Plants	131219	35.667	131219	35.667
Absorption Chillers	0	0.000	0	0.000
Heating Plants	3313633	900.688	3313633	900.688
Pumps	24530	6.668	24530	6.668
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	3585662	974.630	3585662	974.630
Lights	261980	71.210	261980	71.210
Electric Equipment	440049	119.611	440049	119.611
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	4287692	1165.450	4287692	1165.450

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 3679 sqft
  Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Work Room HVAC BL 11-08-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon Page 1 of 1

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	304859	82.865
Heating Loads	1806123	490.928

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	272202	73.988	272202	73.988
Natural Gas	0	0.000	0	0.000
Fuel Oil	3313460	900.641	3313460	900.641
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	3585662	974.629	3585662	974.629
Electric	702029	190.821	702029	190.821
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	4287691	1165.450	4287691	1165.450

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 3679 sqft
  Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Work Room HVAC R1 11-08-94

Weather: Hawthorne (Reno TMY) HAP v3.06

Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	205594	55.883
Heating Loads	1044759	283.979

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	100671	27.364	100671	27.364
Cooling Plants	93303	25.361	93303	25.361
Absorption Chillers	0	0.000	0	0.000
Heating Plants	1907481	518.478	1907481	518.478
Pumps	20160	5.480	20160	5.480
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	2121616	576.683	2121616	576.683
Lights	261980	71.210	261980	71.210
Electric Equipment	440049	119.611	440049	119.611
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	2823645	767.503	2823645	767.503

* Site Energy is the actual energy consumed.

* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %

* Cost per unit floor area is based on the gross building floor area.

Gross floor area...............: 3679 sqft

Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Work Room HVAC R1 — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon — Page 1 of 1

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	205594	55.883
Heating Loads	1044759	283.979

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	214234	58.232	214234	58.232
Natural Gas	0	0.000	0	0.000
Fuel Oil	1907382	518.451	1907382	518.451
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	2121616	576.683	2121616	576.683
Electric	702029	190.821	702029	190.821
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	2823645	767.503	2823645	767.503

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 3679 sqft
  Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Work Room HVAC R2 — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	222933	60.596
Heating Loads	744205	202.285

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	123151	33.474	123151	33.474
Cooling Plants	100345	27.275	100345	27.275
Absorption Chillers	0	0.000	0	0.000
Heating Plants	1356073	368.598	1356073	368.598
Pumps	17200	4.675	17200	4.675
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	1596769	434.023	1596769	434.023
Lights	261980	71.210	261980	71.210
Electric Equipment	440049	119.611	440049	119.611
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	2298799	624.843	2298799	624.843

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 3679 sqft
  Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Work Room HVAC R2 11-08-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon Page 1 of 1

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	222933	60.596
Heating Loads	744205	202.285

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	240767	65.443	240767	65.443
Natural Gas	0	0.000	0	0.000
Fuel Oil	1356003	368.579	1356003	368.579
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	1596769	434.023	1596769	434.023
Electric	702029	190.821	702029	190.821
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	2298799	624.843	2298799	624.843

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 3679 sqft
  Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Work Room HVAC R3 — 11-08-94

Weather: Hawthorne (Reno TMY) — HAP v3.06

Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	202082	54.929
Heating Loads	280356	76.204

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	234292	63.683	234292	63.683
Natural Gas	0	0.000	0	0.000
Fuel Oil	499506	135.772	499506	135.772
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	733798	199.456	733798	199.456
Electric	702029	190.821	702029	190.821
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	1435827	390.277	1435827	390.277

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 3679 sqft
  Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Work Room HVAC R3 — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	202082	54.929
Heating Loads	280356	76.204

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	<----- Site Energy *---->		<---- Source Energy *--->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	125882	34.216	125882	34.216
Cooling Plants	91183	24.785	91183	24.785
Absorption Chillers	0	0.000	0	0.000
Heating Plants	499532	135.779	499532	135.779
Pumps	17200	4.675	17200	4.675
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	733798	199.456	733798	199.456
Lights	261980	71.210	261980	71.210
Electric Equipment	440049	119.611	440049	119.611
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	1435827	390.276	1435827	390.276

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 3679 sqft
  Conditioned floor area.........: 3679 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Mech Room & WCs BL 11-08-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon
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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	4977	1.803
Heating Loads	866002	313.792

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Air System Fans	67965	24.627	67965	24.627
Cooling Plants	1	0.000	1	0.000
Absorption Chillers	0	0.000	0	0.000
Heating Plants	1592014	576.859	1592014	576.859
Pumps	9854	3.570	9854	3.570
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	1669834	605.056	1669834	605.056
Lights	82606	29.932	82606	29.932
Electric Equipment	171558	62.163	171558	62.163
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	254165	92.095	254165	92.095
>>> GRAND TOTAL	1923999	697.152	1923999	697.152

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2760 sqft
  Conditioned floor area..........: 2760 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Mech Room & WCs BL 11-08-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	4977	1.803
Heating Loads	866002	313.792

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	77903	28.228	77903	28.228
Natural Gas	0	0.000	0	0.000
Fuel Oil	1591931	576.828	1591931	576.828
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	1669834	605.056	1669834	605.056
Electric	254165	92.095	254165	92.095
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	254165	92.095	254165	92.095
>>> GRAND TOTAL	1923999	697.151	1923999	697.151

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2760 sqft
  Conditioned floor area..........: 2760 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Mech Room & WCs R1 11-08-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	4977	1.803
Heating Loads	633334	229.486

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	65944	23.895	65944	23.895
Cooling Plants	1	0.000	1	0.000
Absorption Chillers	0	0.000	0	0.000
Heating Plants	1165381	422.270	1165381	422.270
Pumps	6840	2.479	6840	2.479
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	1238167	448.644	1238167	448.644
Lights	82606	29.932	82606	29.932
Electric Equipment	171558	62.163	171558	62.163
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	254165	92.095	254165	92.095
>>> GRAND TOTAL	1492332	540.739	1492332	540.739

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2760 sqft
  Conditioned floor area..........: 2760 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Mech Room & WCs R1 — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	4977	1.803
Heating Loads	633334	229.486

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	72847	26.396	72847	26.396
Natural Gas	0	0.000	0	0.000
Fuel Oil	1165321	422.248	1165321	422.248
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	1238167	448.644	1238167	448.644
Electric	254165	92.095	254165	92.095
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	254165	92.095	254165	92.095
>>> GRAND TOTAL	1492332	540.739	1492332	540.739

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 2760 sqft
  Conditioned floor area..........: 2760 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Mech Room & WCs R3 — 11-08-94
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	5103	1.849
Heating Loads	203225	73.638

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	Site Energy *		Source Energy *	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	68396	24.783	68396	24.783
Cooling Plants	1	0.000	1	0.000
Absorption Chillers	0	0.000	0	0.000
Heating Plants	369488	133.882	369488	133.882
Pumps	6840	2.479	6840	2.479
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	444725	161.144	444725	161.144
Lights	82606	29.932	82606	29.932
Electric Equipment	171558	62.163	171558	62.163
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	254165	92.095	254165	92.095
>>> GRAND TOTAL	698890	253.239	698890	253.239

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2760 sqft
  Conditioned floor area..........: 2760 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Mech Room & WCs R3 11-08-94
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon Page 1 of 1

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	5103	1.849
Heating Loads	203225	73.638

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	75256	27.269	75256	27.269
Natural Gas	0	0.000	0	0.000
Fuel Oil	369469	133.875	369469	133.875
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	444725	161.144	444725	161.144
Electric	254165	92.095	254165	92.095
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	254165	92.095	254165	92.095
>>> GRAND TOTAL	698890	253.239	698890	253.239

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area...............: 2760 sqft
  Conditioned floor area..........: 2760 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Control Room Area Insul — 02-08-95
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	48684	28.453
Heating Loads	52258	30.542

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	26514	15.496	26514	15.496
Cooling Plants	15789	9.228	15789	9.228
Absorption Chillers	0	0.000	0	0.000
Heating Plants	79829	46.656	79829	46.656
Pumps	16942	9.902	16942	9.902
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	139073	81.282	139073	81.282
Lights	68896	40.266	68896	40.266
Electric Equipment	76064	44.456	76064	44.456
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	144960	84.722	144960	84.722
>>> GRAND TOTAL	284033	166.004	284033	166.004

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 1711 sqft
  Conditioned floor area..........: 1711 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Control Room Area Insul 02-08-95
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon
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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	48684	28.453
Heating Loads	52258	30.542

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	59249	34.628	59249	34.628
Natural Gas	0	0.000	0	0.000
Fuel Oil	79825	46.654	79825	46.654
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	139073	81.282	139073	81.282
Electric	144960	84.722	144960	84.722
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	144960	84.722	144960	84.722
>>> GRAND TOTAL	284034	166.004	284034	166.004

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 1711 sqft
  Conditioned floor area..........: 1711 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Work Areas Insulated — 02-08-95
Weather: Hawthorne (Reno TMY) — HAP v3.06
Prepared by: Keller & Gannon —

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	510610	54.893
Heating Loads	27890	2.998

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	63736	6.852	63736	6.852
Cooling Plants	72723	7.818	72723	7.818
Absorption Chillers	0	0.000	0	0.000
Heating Plants	35998	3.870	35998	3.870
Pumps	56755	6.101	56755	6.101
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	229212	24.641	229212	24.641
Lights	266135	28.610	266135	28.610
Electric Equipment	1215471	130.668	1215471	130.668
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1710817	183.919	1710817	183.919

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
Gross floor area...............: 9302 sqft
Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Work Areas Insulated 02-08-95
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	510610	54.893
Heating Loads	27890	2.998

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	193216	20.771	193216	20.771
Natural Gas	0	0.000	0	0.000
Fuel Oil	35996	3.870	35996	3.870
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	229212	24.641	229212	24.641
Electric	1481606	159.278	1481606	159.278
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	1481606	159.278	1481606	159.278
>>> GRAND TOTAL	1710818	183.919	1710818	183.919

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 9302 sqft
  Conditioned floor area..........: 9302 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-3. Mechanical Room Insul. 02-08-95
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501282	170.272

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	Site Energy *		Source Energy *	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	50989	17.320	50989	17.320
Cooling Plants	0	0.000	0	0.000
Absorption Chillers	0	0.000	0	0.000
Heating Plants	841041	285.680	841041	285.680
Pumps	54214	18.415	54214	18.415
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	946244	321.414	946244	321.414
Lights	57653	19.583	57653	19.583
Electric Equipment	615955	209.224	615955	209.224
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	673607	228.807	673607	228.807
>>> GRAND TOTAL	1619851	550.221	1619851	550.221

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2944 sqft
  Conditioned floor area..........: 2944 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-3. Mechanical Room Insul. 02-08-95

Weather: Hawthorne (Reno TMY) HAP v3.06

Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	0	0.000
Heating Loads	501282	170.272

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	105247	35.750	105247	35.750
Natural Gas	0	0.000	0	0.000
Fuel Oil	840997	285.665	840997	285.665
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	946244	321.414	946244	321.414
Electric	673607	228.807	673607	228.807
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	673607	228.807	673607	228.807
>>> GRAND TOTAL	1619851	550.221	1619851	550.221

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2944 sqft
  Conditioned floor area..........: 2944 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Work Room HVAC Insul. 02-08-95
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	182927	49.722
Heating Loads	22900	6.225

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	Site Energy *		Source Energy *	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	123887	33.674	123887	33.674
Cooling Plants	83163	22.605	83163	22.605
Absorption Chillers	0	0.000	0	0.000
Heating Plants	38022	10.335	38022	10.335
Pumps	14461	3.931	14461	3.931
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	259533	70.544	259533	70.544
Lights	261980	71.210	261980	71.210
Electric Equipment	440049	119.611	440049	119.611
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	961563	261.365	961563	261.365

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 3679 sqft
  Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Work Room HVAC Insul. 02-08-95

Weather: Hawthorne (Reno TMY) HAP v3.06

Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	182927	49.722
Heating Loads	22900	6.225

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

Component	<----- Site Energy *----> (kBTU)	(kBTU/sqft)*	<---- Source Energy *---> (kBTU)	(kBTU/sqft)*
Electric	221513	60.210	221513	60.210
Natural Gas	0	0.000	0	0.000
Fuel Oil	38020	10.334	38020	10.334
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	259533	70.544	259533	70.544
Electric	702029	190.821	702029	190.821
Natural Gas	0	0.000	0	0.000
Fuel Oil	0	0.000	0	0.000
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
>>> Non-HVAC Total	702029	190.821	702029	190.821
>>> GRAND TOTAL	961563	261.365	961563	261.365

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 3679 sqft
  Conditioned floor area..........: 3679 sqft

ENERGY BUDGET BY SYSTEM COMPONENT

Building: 117-5. Mech Room & WCs Insul. 02-08-95
Weather: Hawthorne (Reno TMY) HAP v3.06
Prepared by: Keller & Gannon

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	5416	1.962
Heating Loads	128103	46.417

TABLE 2. ENERGY CONSUMPTION BY SYSTEM COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	68404	24.786	68404	24.786
Cooling Plants	1	0.001	1	0.001
Absorption Chillers	0	0.000	0	0.000
Heating Plants	231111	83.742	231111	83.742
Pumps	6835	2.477	6835	2.477
Cooling Towers	0	0.000	0	0.000
>>> HVAC Total	306352	111.005	306352	111.005
Lights	82606	29.932	82606	29.932
Electric Equipment	171558	62.163	171558	62.163
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
>>> Non-HVAC Total	254165	92.095	254165	92.095
>>> GRAND TOTAL	560516	203.100	560516	203.100

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2760 sqft
  Conditioned floor area..........: 2760 sqft

ENERGY BUDGET BY ENERGY SOURCE

Building: 117-5. Mech Room & WCs Insu. 02-0
Weather: Hawthorne (Reno TMY) HAP v
Prepared by: Keller & Gannon Page 1 o

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TABLE 1. ANNUAL COIL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads	5416	1.962
Heating Loads	128103	46.417

TABLE 2. ENERGY CONSUMPTION BY ENERGY COMPONENT

	<----- Site Energy *---->		<---- Source Energy *--->	
Component	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Electric	75253	27.267	75253	27.267
Natural Gas	0	0.000	0	0.000
Fuel Oil	231099	83.738	231099	83.738
Propane	0	0.000	0	0.000
Remote Heating	0	0.000	0	0.000
Remote Cooling	0	0.000	0	0.000
>>> HVAC Total	306352	111.005	306352	111.005
Electric	254165	92.095	254165	92.
Natural Gas	0	0.000	0	0.
Fuel Oil	0	0.000	0	0.
Propane	0	0.000	0	0.
Remote Heating	0	0.000	0	0.
>>> Non-HVAC Total	254165	92.095	254165	92.
>>> GRAND TOTAL	560516	203.100	560516	203.100

* Site Energy is the actual energy consumed.
* Source Energy is the site energy divided by the electric generating efficiency of 100.0 %
* Cost per unit floor area is based on the gross building floor area.
  Gross floor area................: 2760 sqft
  Conditioned floor area..........: 2760 sqft